

Chapter 3 Project Planning

Poor Planning Strategy

The principal cause of delay in execution of the critical Udhampur- Qazigund section, in our opinion, was the under-estimation of the challenging geological terrain of the chosen alignment and the failure to carry out complete due diligence process¹, as laid down in the Engineering Code of Indian Railways, before deciding on the gradient and the alignment.

The project estimates were approved without seeking an assurance on the feasibility of construction of bridges and tunnels through a geologically heterogeneous terrain covering major seismic areas. The project estimates based almost exclusively on data obtained from aerial mapping of areas that were inaccessible on account of difficult terrain also overlooked the costs of constructing about 300 kms of approach roads required for servicing the project. The flat gradient of 1:100 adopted for the alignment of the rail link was expected to yield maximum geographical coverage in terms of neighbourhood habitations in the region but also carried maximum geological risks. However, no feasibility studies in terms of preliminary surveys and geo-technical investigations duly followed by a final location surveys were carried out before deciding on the alignment and actual commencement of works. Difficulties have been encountered in the designing and construction of major bridges across Anji and Chenab rivers on account of their inconvenient locations and instability and steepness of the hill slopes abutting the rivers. The alignment also required constructions of 109 kilometres of tunnels (81) requiring 162 number of tunnel portals which posed problems of safety in terms of rescue and relief operations and security of installations. These issues raised by the construction agencies involved in the execution of the work were not properly resolved at the initial stage. RITES were engaged to carry out pre- construction geo-technical investigations of the alignment within pre-specified parameters limiting the scope of available options for decision on viability of the alignment and the project.

The lack of authoritative finding on the constructability of the alignment clearly had the potential to create a discord between the construction agencies and Northern Railway that eventually resulted in stoppage of work leading to a belated constitution of an Expert Committee for reviewing the alignment. Owing to huge commitments for a prolonged period already made in terms of time and resources on the project, the Committee recommended continuance of the alignment with modifications and further studies on problem areas. Thus, the project authorities pursued a high cost strategy by not carrying out proper due diligence process to evaluate the possible risks of

¹ See Annexure I page no 70-71

² 'Khad' refer to dry bed of a seasonal river.

covering a very vast and uncertain geological terrain leading to uncontrolled costs and abandonment of works due to difficulties in the alignment.

3.1 Survey requirements

An important aspect of quality of planning is due consideration at the initial stage of material risk factors likely to impact on project execution and steps for mitigation. As per the Engineering Code, the administrative sanction for a new Line Project should be accorded after conducting investigations that include Reconnaissance and Preliminary Engineering Survey of few alternative alignments and selecting the best from financial and operating point of view. The selection of the gradient is not the only criterion but other factors such as level of traffic, speeds envisaged including mode of traction, etc are material considerations influencing unit cost of bringing rail connectivity. The due process of consideration of the options leading up to the administrative sanction is required to be recorded and preserved in the Detailed Project Report (DPR). However, the technical sanction for commencing the execution of work should be accorded only on completion of extensive investigations and Final Location Survey of the selected alignment.

3.2 Udhampur-Qazigund Section

The alignment chosen by the Ministry of Railways to connect Baramullah with Jammu via Srinagar lies through Udhampur- Katra- Qazigund section (168 Kms) in the western corridor of the Pir Panjal mountain ranges and is located close to the Line of Control. The major cities /towns located in the western corridor of Pir Panjal range are Katra, an important pilgrim centre, Reasi a District Headquarters and the Salal hydel project, a tourist attraction.

The alignment under construction has a ruling gradient of 1:100 requiring a total height of 1100 metres to be gained between Katra and Qazigund. The terrain is characterized by steep hills and valleys of lesser Himalayas. The geophysical complexities of the terrain include active thrusts and fault lines like the Himalyan Frontal Thrust (HFT), Reasi, Sirban, Muree and Panjal (see map at Page 66). The alignment passes through major water bodies beyond Katra including Pie Khad, Anji Khad² and Chenab River. The geo-physical terrain spanning these thrusts and fault lines had remained unexplored owing to poor accessibility and scant population.

3.3 Selection of alignment

Decision on the alignment on the western corridor was taken without conducting necessary surveys and geo-technical studies.

Qazigund is an obligatory point in the alignment being the gateway to Kashmir Valley from both western and eastern corridor (see map at page 67). Before the choice of location of the alignment fell on western corridor, the options based on reconnaissance and engineering cum traffic survey carried out by RITES in the eastern corridor in 1986-87 were considered. These consisted of three alternative gradients ranging from 1:40/50/100, the recommended option being 1:100 wherever possible and rest with 1:50/60 with an estimated cost of ₹ 776.94 crore entailing a route length of 150.75 kms after considering cost, speed potential, operation and maintenance factors. The Geological Survey of India (GSI), in 1994-95, also had recommended alignment through the eastern corridor as the same was located along the National Highway whereas the western corridor from Jyotipuram (Salal) to Banihal was largely inaccessible. Northern Railway subsequently (Feb 1994) submitted a proposal of three options- two through eastern corridor with gradients of 1:40 (120 kms) and 1:100 (198 kms) and third through western corridor with a gradient of 1:100(167 kms).³ For reasons not recorded in the Detailed Project Report (DPR) approved in 1999, these proposals overlooked the option in the eastern corridor recommended by RITES in the eighties.

The Ministry of Railways initially conveyed approval of the alignment passing through the eastern corridor with a steep ruling gradient of 1:40 (March 1994) only to reverse the same in the very next year (June 1995) on the ground of limited speed potential due to steeper gradient, higher consumption of motive power and requirement of catch siding⁴ (in case of slippage of train) in favour of the alignment through the western corridor with a ruling gradient of 1:100 covering Udampur-Baramula. The decision was justified on the ground that the western corridor permitted a flatter gradient touching important locations viz., Katra and Salal and would cover maximum neighbouring habitations. Technological advances in motive power and other safety features that were already in prevalence to negotiate steep gradients in the Indian Railways and elsewhere were ignored. Further, we observed that while opting for the western corridor vis-a-vis the eastern corridor, the relative inaccessibility of the western region including the geological uncertainty was not given due weightage vis-a-vis the eastern region which already enjoyed proximity to National Highway and the decision to cover maximum areas by opting for a flatter gradient was not consistent with the ground reality of the scant populations inhabiting the region. This pre-determined gradient option however was not derived from prior ground surveys/studies and precluded fair considerations of other viable alternatives being explored in the western corridor. We did not find evidence of due

³ Refer to Annexure II page No.72.

⁴ 'Catch siding' refer to a siding along a steep railway grade so placed as to catch run away wagon/ train.

consideration being given to critical issues of constructability, safety and security aspects including financial viability at the time of selection of alignment in the western corridor.

The selected alignment covered maximum number of fault lines and active thrust areas out of which 30-40 kms of route lengths run either through or parallel to such fault lines posing construction risks. The alignment was also close to Salal dam, a source of seismic tremors. Major rivers namely Chenab and Anji were passing through inconvenient locations including unstable slopes that required construction of mega bridges of complex design. In all, the alignment entailed construction of 81 tunnels and 69 major bridges, one of them located over the Chenab river with a height of 363 metres above bed level & width of 1063 metres. Moreover, the alignment had a large portion of uninhabited and inaccessible terrain that required the construction of about 300 kms of approach roads.

However, no preliminary surveys and geo-technical investigations as prescribed under the relevant codes were carried out to ensure the feasibility/constructability of the selected alignment. The Expert Committee later constituted by the Railway Board in 2008 to review the alignment issues also acknowledged that the decision to commence works was taken without the benefit of detailed geo-technical examination. Thus, the decision to deliver maximum rail connectivity was not supported by due diligence process.

The complex and uncertain geology of the region warranted utmost care in conducting necessary feasibility studies so as to mitigate costs on account of uncertainty. On the contrary the project authorities relied exclusively on the data from the satellite imagery of the region obtained from National Remote Sensing Organisation and aerial photographic maps of Geological Survey of India that were not validated with inputs by way of foot-by-foot surveys and other geo-technical investigations of the sub-strata between Katra- Qazigund. The requirement of Final Location Survey for staking of the alignment on the ground and for confirmation of the detailed estimates before their approval was dispensed with until at a later stage. Thus, the abstract estimates of ₹ 1500 crore on which administrative sanction had been obtained in 1994-95 and the project estimates incorporated in the DPR sanctioned in 1999/2000 for ₹ 3077 crore as well as the projected date of completion of the work (Aug 2007) were of doubtful reliability. Moreover, these had completely omitted the material factor of cost of constructing approach roads and also the costs of safeguarding large number of tunnel portals and bridges.

Despite the fact that the alignment had not been properly investigated, the Railway Board gave a 'go-ahead' to commence work by including part of the alignment i.e. section between Udhampur-Katra in March 1995 and contract

work was commenced in 1998 by Northern Railway. Later, in February 1999, Railway Board sanctioned commencement of work on the section Qazigund-Baramullah. It was, thus, clear that the Railway Administration had planned to commence works on the alignment from both ends without investigating the most difficult portion between Katra - Qazigund. Administrative and technical sanctions were thus accorded by Railway Board without adhering to the due diligence process as laid out in the Railway Codes.

When the matter was taken up with the Ministry in March 2011, the Ministry accepted (September 2011) that the abstract estimates were based on aerial surveys carried out and ground surveys were not carried out on account of inaccessible terrain. It was decided that the works would be allowed to commence along with surveys and investigations to be carried out by the contracted agencies, as this course would yield visible progress on the ground and the option for completion of all investigations would have entailed 2-3 years of delay before commencement. However, the course adopted was counter-productive as the same ignored the costs of risks of committing resources without conducting due diligence and was in total violation of prescribed procedures that mandated necessary ground surveys before commencement of works. In a project of such magnitude and complexity, a period of two to three years' investigation of the terrain was indispensable to chalk out a well-founded plan of action.

The Ministry also contended that in 1994, the Railway Board had never approved the proposals of Northern Railway of two gradients of 1:40 and 1:80 for Udhampur to Qazigund and Qazigund to Srinagar respectively. However, audit found that the Expert Committee later constituted (2008) had expressed in its Report that the Board vide their letter dated 29 March 1994 had conveyed its decision for selecting alternative-I i.e. 1:40 gradient through eastern corridor that was later reversed, as already mentioned above.

The Ministry further replied that the various thrust areas and water bodies through which the chosen alignment was passing would be a common feature in the case of any other options and have to be necessarily crossed, whichever the alignment. Also, it was argued that it was not correct that the alignment lay through maximum thrust areas or fault lines. On the question of line through eastern corridor, it was argued that the ruling gradient would never exceed 1 in 50 and the flatter gradient could not be achieved.

These arguments do not hold good for the reason that the chosen alignment resulting from a decision on gradient of 1 in 100 should have been properly investigated, for a clearer appreciation of the terrain and the substrata, the relative stable and weak areas, the positioning of the alignment through the thrust areas/fault lines that would have yielded a more realistic magnitude of the scale of construction costs involved including the safety and security aspects. The lack

of due diligence in conducting a detailed investigation of the uncertain and complex terrain in the interests of expediency reflected a short-sighted approach and lack of fair application of professional standards.

3.4 Construction Strategy

The pre-construction surveys that should have preceded technical sanctions were actually taken up after the commencement of works and proceeded hand-in-hand.

When the project was declared as one of national importance to be funded by Government of India (2002), Railway Board, in December 2002 i.e. even before the Final Location Survey- a pre-requisite for commencement of works- had been conducted, entrusted the execution (role of engineer) of this section (barring 5 Km beyond Katra assigned to NR) to two Public Sector Undertakings under the overall control of NRCO (Northern Railway Construction Organisation). Section Katra-Laole (120 KM), deep inside the Pir Panjal mountains, was assigned to Konkan Railway Corporation (KRCL) while Laole-Qazigund (44 Kms) entrusted to Ircon International Limited (IRCON). The arrangement stipulated that the agencies shall get pre-construction surveys undertaken through RITES in respective sections assigned to each agency, preparatory to works commencement. Consequently, RITES, for the first time carried out geo-technical investigations of the selected alignment on Katra- Qazigund stretch by stretch that constituted a pre-construction survey. RITES were expected to focus their efforts on pre-selected parameters and IRCON and KRCL were expected to work in association with RITES who would hand over segments investigated for construction work in piecemeal fashion. This strategy entailed the high risk of works being abandoned or discard of the assets created in the event of the route being rendered unworkable. This approach also highlighted the fact that the authorities had not made due allowances for contingencies that might call the alignment itself into question. The construction agencies were expected to proceed with commencement of works simultaneously with investigation and were not expected to come up with alternative options. We noted that RITES recommended a few modifications in the alignment with some qualifications on the risk of construction along active thrust areas, but no safety issues were addressed. We also noticed that the confirmatory drilling was confined to drilling of one borehole on each tunnel portal. However, considering the diversity of the terrain, the investigations carried out were inadequate and required further investigations subsequently.

The Ministry, in their response, reiterated that the strategy was to pursue investigation and construction simultaneously for achieving quick visibility of progress of work. The reply was, however, silent on the implications of following a high risk strategy with a high probability of becoming counter-productive in the

absence of thorough investigation and assurance on the viability of the alignment. The reply that their approach fulfilled the codal provisions indicated total disregard of professional norms and inability of the Railway Board in enforcing compliance with the standards laid down in the Engineering Code.

The lack of authoritative finding on the constructability of the alignment resulted in discord between the construction agencies engaged and the railway authorities on continuing constructions on the pre-determined alignment.

3.5 Workability of the alignment

A chronology of major events is given below bringing out discord between the construction agencies and the Ministry.

Chronology of Major Events after project commencement

Period	Event
December 2002	Contracts for construction (including survey) were awarded to KRCL and IRCON based on “paper alignment” ⁵
September 2003	After field study undertaken by it with assistance from IIT Mumbai, KRCL proposed change in alignment (on a “straight line” basis), with a steeper gradient of 1:50. It also suggested setting up of a Committee of Experts. The proposals were not agreed to by Railway Board on the ground that a flatter gradient more than 1: 30 was not possible.
August 2007	Railway Board ordered NRCO to award a section of the line (km 100.868 to km 120) to IRCON, which was originally awarded to KRCL. Again in Oct 2011, NRCO had proposed withdrawal of a part stretch km.61-km191 from KRCL. Pending decision on the proposal, Railway Board had ordered(June 2012) that KRCL shall not enter into any fresh financial commitments on the stretch.
December 2007	NRCO suggested fresh alignment survey along with geological feasibility with 1:50 gradient, and holding execution of works under existing contracts in abeyance.
July 2008	Railway Board decided to suspend work on the sections from km 30 to km 34 and km 52 to km 144 till a final decision on alignment was taken.
October 2008	Railway Board decided to suspend work on the entire alignment from km 30 to 144, and re-examine the sites of the Anji and Chenab bridges, since their location was

⁵ ‘paper’ alignment’ refers to an alignment marked on paper without field studies.

	problematic.
September 2009	Alignment was amended by Railway Board

3.6 Alternative proposed by KRCL and NR

After a detailed study of the paper alignment provided by Railways and based on its own experience of construction and operation of Konkan Railway Project and opinion of expert agencies like Geological Survey of India and IIT Mumbai, KRCL proposed (September 2003) a re-working of the alignment on account of the following factors:

- Major stretches of the alignment passed through a number of Himalayan thrust areas and long portions of track running parallel to and within the thrust areas, which could cause grievous natural disasters during construction as well as during operation and maintenance;
- The alignment consisted of a number of major bridges, of which bridges at Anji Khad and Chenab River were gigantic and no such bridges had ever been built in India before;
- The Salal Dam was in close vicinity and was likely to cause minor reservoir induced tremors, which had been observed in Himalayan region; and
- The alignment contained sharp and reverse curves and also deep cuttings in approaching the Tunnel portals.

Considering the above, KRCL apprehended that in case of any damage to the bridges, repairs would be very difficult and the line will have to remain closed for lengthy periods. Further, it was felt by KRCL that in the absence of proper geotechnical studies, the expenditure incurred on the stretch would be infructuous, in case the alignment proved unworkable at a later stage. In view of above, they proposed a straight alignment through long tunnels with a gradient of 1:50.

KRCL further stated that the alternative alignment put forward by it would result in cost saving by ₹ 5000 crore due to reduced length, elimination of major bridges, reduction in number of portals and reduction in deep cuttings in slopes. A comparative position of Northern Railway alignment and the alignment proposed by M/s KRCL in Katra-Qazigund section is given below.

Alignment proposed by Railways (in violet) and KRCL (in red)

KATRA - QAZIGUND

COMPARATIVE STATEMENT

S.No.	Technical Features	N. Rly Alignment	Proposed Alignment
Engineering			
1	Route Length	138 Km	71.5 Km
2	No. of lines	Single	Twin Single Lines
3	No. of Major Bridges	62 (2 Critical)	3 (Simple)
4	Bridges Minor	132	3
5	Tunnel No.	76 (152 Portals)	4 (8 Portals)
	Length km	87.2	68
6	New Road construction (in Kms.)	300	60
7	Stations	9	5
Geo-technical			
8	i) No. of lineaments (Shear Zones)	14	3
	ii) Track running parallel to thrust (in Kms.)	26	Nil
9	Proximity to Reservoirs / Dam	5 Km.	10 Km.
Environment			
1	Open cut & susceptibility landslide (in Kms.)	20.8	3
2	Distance from snow line (in Kms.)	16	19
3	Land reqd.	10,000 kanals	1500 kanals
Project Management			
1	Cost	Rs 8500 cr	Rs. 6153 cr
2	Time frame	11 years	8 years
3	Expected finished cost	Rs 12582 cr	Rs 8177 cr.
Operational			
1	Security and reliability	Risky & unreliable	Reliable.
2	Operation & Maintenance	Complex & Intensive	Simpler & mostly maintenance free
3	Average Speed	30 KMPH	60 KMPH
4	Travel time	4 - 5 Hours	1 Hour 15 mints.



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KRCL's proposal was not agreed to by the Railway Board as it involved a steeper gradient. KRCL, in its letter to the Chief Administrative Officer (CAO), NRCO in September 2003, suggested setting up a Committee of Senior Experts to examine the alternative proposal and take a view in the matter.

However, the Railways did not agree to the suggestion of KRCL to adopt an alternative alignment with a projected gradient of 1:50 and asked it to expedite the work on the original alignment. The Board was of the opinion that KRCL proposal did not represent the ground reality and the gradient would actually be of the order of 1:30. Thereafter (2003), KRCL took up the assigned work as per the original alignment given by the Railways.

In this regard, we noted that KRCL, despite strong misgivings about the workability of the alignment, proceeded to execute works many of which failed/were abandoned which indicated lack of professionalism on the part of KRCL.

Subsequently, in December 2007, NRCO reported to the Railway Board that KRCL and IRCON were facing the following difficulties in execution of the project from Katra to Qazigund:

- Ruling gradient of 1:100 had resulted in increase in the route length to 148 kms against a straight distance of 75 kms;
- About 44 per cent of the track was on curves; there were 66 tunnels with a total length of 112.35 kms, constituting 76 per cent of the total route length; 45 out of the 66 tunnels were on curves; and out of 132 tunnel portals, 77 were on curves or within 200 mtrs of curves.
- The alignment required 119 bridges, with two very large arch bridges of spans 460 mtrs (Chenab) and 260 mtrs (Anji);
- Serious problems in tunnelling work had been encountered in KRCL portion from Km.30 to Km 52 and from km. 131 to 144 in IRCON's portion.

NRCO also reported to the Railway Board that after examining the section in detail, a gradient of 1:50 was considered feasible and that double line or twin single lines would be a more feasible option to carry out relief and rescue operations in case of emergencies in tunnels which were more than 3 km in length. Based on this assessment, NRCO further requested Board to approve fresh alignment survey along with geological feasibility and hold the execution of works under the existing contracts under abeyance, since further execution would lead to infructuous expenditure in case new alignment with a gradient of 1:50 was adopted. The difficulties communicated by various construction agencies, experts, then Member Engineering and Northern Railway with the existing alignment with a ruling gradient of 1:100 to the Railway Board are placed in the Box. These had inter alia, highlighted security risks and problems of stability and safety and constructability and maintenance of structures.

Risks with the Existing Alignment on Katra- Qazigund Section have not been fully addressed

The risks on account of curved alignment, greater number of tunnel portals, greater number of major/special bridges, doubtful stability and security risk etc. have not been addressed and continue to persist:

- *CAO/NRCO's concerns (December 2007) relating to the problems with the existing alignment, involving a flatter gradient of 1:100 and his request for permission to carry out detailed investigation for a direct line from Katra to Qazigund with a gradient of 1:50 were not agreed to by the Railway Board.*
- *Dr. Golsar of M/s Geo Consult (a member of the Expert Committee), in a meeting with Railway Board in October 2008 opined that the present alignment had very major shortcomings, which would result in serious problems for stability, safety, rescue and restoration, constructability and operational/maintenance. He felt that a gradient of 1:50 would ensure stability and safety due to reduced length of curves, favourable conditions of terrain and geology in valleys between the main mountain ridges of the area, and reduced size of bridges and that, such an alignment would also minimize skirting and cross the fault lines at a favourable angle.*
- *The then Member Engineering, in his detailed analytical note in November 2008, also recommended a straight alignment with steeper gradient to ensure stability and safety.*
- *Shri E. Sreedharan, Managing Director, Delhi Metro Rail Corporation Limited, vide his letter dated May 2009 to the Expert Committee, pointed out that the existing contour alignment would not be stable and the high bridges would be highly vulnerable from security point of view and had suggested that direct route through long tunnels, cutting across fault zones should be adopted with a ruling gradient of 1:40.*
- *Shri AK Verma, Chief Engineer, Northern Railway who worked on the project for two years, examined the various geological reports, visited the project sites extensively and also examined similar hilly projects overseas had submitted in his presentation to the Expert Committee in January 2009, that the existing alignment lacked a sound underlying concept for safety and viability and was not feasible, as the alignment is passing through thrust zones, consists of high bridges, tunnel portals are located on curves, curves in tunnels restrict the visibility at critical locations, high maintenance cost due to higher number of bridges and tunnel portals and higher security risk due to high bridges etc. and suggested a modified alignment with 1:50 gradient.*

Pursuant to extensive deliberations in this regard in February 2008, Railway Board decided (July 2008) to suspend the work between km 30 to km 34 and km 52 to km 144 till a final decision on alignment was taken. The Board also decided to belatedly engage an internationally accredited agency⁶ in Oct 2008 for expert advice on the suitability of the alignment from geological considerations. At the same time, considering that the location of Anji and Chenab bridges was problematic, Railway Board decided to examine the sites of these bridges and hence the work on the entire alignment from km. 30 to km 144 was suspended.

This was followed by constitution of an Expert Committee by the Railway Board in December 2008 under the Chairmanship of Shri M. Ravindra, ex-CRB to review the alignment.

The international consultant was asked to work around the current alignment or to suggest an alternative alignment subject to certain mandatory parameters like gradient 1:60 and obligatory points namely Reasi station near Anji Khad bridge, Salal station at Chenab bridge and Sangaldan station to be covered, where works were already underway and planned along the existing alignment. Accordingly, the Consultant submitted options but felt that had he been given a free hand, he could have provided an optimal solution.

The Expert Committee recommended (June 2009) acceptance of the realignment with a gradient up to 1:60 as suggested by M/s Amberg as well as adoption of suitable remedial/protective measures in the areas already under construction and was constrained to observe that no alternative alignment could be considered at this stage in view of the commitments already made on the public exchequer apart from public expectations on the rail connectivity. Despite the Committee's recommendations, the Railway Board ruled in favour of adoption of ruling gradient of 1:80 on the ground that catch sidings were required for steeper gradients. However, these issues had been considered by the Expert Committee who had acknowledged the existence of much steeper gradients on Indian Railways and the use of high powered locos dispensing with requirement of catch sidings. The suspended work was recommenced by KRCL, wherever, the realignment was not involved (September 2009). Though, a decision regarding location of Anji Bridge on Katra- Reasi section was taken in April 2010, the actual works could not commence, as the Ministry was reconsidering the issue in favour of another location(July 2012).

⁶ 'Internationally accredited agency' refer to Amberg Engineering, Switzerland who are a specialised engineering designer for underground structures.

3.7 Modified Alignment

The Railway Board approved modifications in the alignment in certain stretches (85 out of 138 kms between Katra and Qazigund), with associated changes in gradient (1:80 instead of 1:100). The realignment of Katra- Qazigund effected a reduction of 21 Kms of route-lengths and number of tunnels to 29 and major bridges to 34. The decision resulted in abandonment of 15 tunnels measuring 3.5 Km and 8 bridges both together valued ₹ 226.39 crore as discussed under Chapter on Execution of Works. The changed alignment represented only piecemeal changes in different parts of the Katra – Qazigund sections and did not comprehensively factor in the wholesale changes suggested by the experts consulted by the Committee (who suggested a change in alignment and steeper gradient in the interests of safety and stability of the line). While the modified alignment reduced the total distance and number of bridges and tunnels to be constructed, the Expert Committee recommended further field investigations in respect of unstable locations and highlighted need for provisioning of twin tube tunnel along the entire alignment. The Ministry, in reply stated that constructability, safety and stability issues had been adequately addressed both initially and at subsequent stages. The assertion of the Ministry is not factually correct as the issues of constructability of the alignment were not debated before the selection of the alignment and subsequent investigations conducted by RITES and M/S Amberg revealed problem areas requiring further investigation. Audit also noted that the Railway Board belatedly took a decision in September 2010 to incorporate provision of twin tunnel for tunnel length of more than three Kms, where geological conditions necessitated. As the Railway Board further opted for modified alignment with a gradient of 1:80 instead of 1:60 recommended by the Expert Committee, assurance on issues of constructability, maintainability and safety still remained. Two sketches depicting sections of modified alignment vis-a-vis existing alignment between Katra – Dharam (executed by KRCL) and Dharam – Banihal (executed by IRCON) are placed at Page Nos. 68 and 69. The physical progress being very slow as of July 2012 (ranging from 12 to 14 per cent in Katra – Banihal section (km.30-km150), the project is unlikely to be completed within the rescheduled time frame of 2017.

3.8 Impact of inadequate studies

The uncertainty arising from lack of geo-technical investigations before decision on alignment and subsequent decision to combine investigation and execution of works contracts resulted in adverse consequences in terms of time delays with cost over-runs, besides assets being abandoned as summarised under:

- Preparation of designs and drawings of tunnel portals and bridges was delayed and in some cases, the design had to be changed, leading to time and cost over runs.
- Ten tunnels in KRCL jurisdiction and five tunnels in IRCON jurisdiction had to be abandoned due to the alignment passing through thrust areas or parallel to thrust areas.
- Four tunnel portals collapsed during construction. .
- The alignment from km 52 to km 62 had to be changed in 2006 due to the enormity of the height of the bridges and long spans, thus rendering an expenditure of ₹ 15.42 crore infructuous. With the change in alignment in this section once again in 2009, the works already executed in tunnel No.9 have been abandoned, resulting in infructuous expenditure of ₹ 3.70 crore.
- The changes in alignment, as a result of final decision conveyed (Sep 2009) would also result in fresh acquisition of land on re-aligned stretches. The actual area of land required and the expenditure involved can be assessed only after freezing the alignment and issuing the final awards by the land acquisition authorities. Besides cost overrun, further time overrun due to the land acquisition process cannot be ruled out.

Financial impact on account of suspension of works / foreclosure of contracts.

- *Railways had to suspend the work in the Katra-Banihal section for over a year (July 2008 to September 2009), resulting in abandoning the executed works amounting to ₹ 226.39 crore.*
- *Due to midway suspension of work, contractors have claimed damages on account of idle manpower/ machinery and cost of financing etc. As of July 2012, claims amounting to ₹ 57.24 crore have been admitted.*
- *Prolonged suspension period led to termination of contracts that had been awarded between 2003 and 2005. The extra financial impact in respect of six works, which were retendered during 2010 was ₹ 1097.34 crore. The actual cost and extra financial impact on remaining works will be known only after these works are retendered and awarded afresh.*

NRCO stated that they had saved about ₹ 2000 crore by reducing the length of the line by 21 kms as a result of change in alignment. This contention however ignores the fact that the purported savings were claimed after effecting changes

in alignment at a very delayed stage and would have to be weighed against the overall time and cost over-runs and losses attributable to poor planning strategy and lack of due diligence. The response of the Ministry that the best course of action was taken considering the ground reality of inaccessible terrain and disturbed security situation however overlooked the fact that suitable options were not explored by conducting due diligence for technical feasibility before selection of the alignment. After the administrative approval of the project in 1994-95, no action was initiated to undertake geo-technical investigations of the alignment sanctioned for more than eight years till December 2002 when the construction contracts were awarded. The Ministry in their reply admitted that geological problems had been encountered during tunnelling and suspension of work was ordered to avoid further controversy.

3.9 Land Acquisition/ Forest clearance

Land availability for construction of tunnels, bridges and not the least for construction of approach roads were vital to ensure timely commencement of works and their completion. The piecemeal approach adopted for conducting investigations of the alignment and finalising land requirements was not in accordance with the prescribed policy governing execution of works. This strategy resulted in indents being placed in part portions investigated while there was uncertainty in regard to remaining stretches pending investigations and hampered execution of contracts for lack of final determination/non-availability of land. Moreover, the strategy resulted in discard of the land acquired, as discussed in the succeeding paragraphs, when the alignment had to be modified.

The terms of the contract between Railways and KRCL/IRCON envisaged that land required for execution of the project was to be provided by the Railways to the latter. Further, where the acquired land belonged to the Forest department, the necessary clearances were also to be obtained by the Railways. However, as seen from a scrutiny of the records and execution of the contracts, there were huge delays in acquisition of the required land for laying the line and carrying out the associated works like construction of approach/feeder roads, buildings – both officers and staff quarters and other protection works. In fact, non-availability of the required land and lack of the requisite clearances was one of the primary reasons for termination/ foreclosure of contracts in Leg III (Qazigund-Baraamullah). In respect of Leg II (Katra-Qazigund), the problem had not yet been addressed adequately as of July 2012, as can be seen from the details given below:-

(Figures in hectare)

Executing Agency	Total land required	Land acquired	Balance yet to be acquired
KRCL	828.11	555.06	273.05
IRCON	386.37	317.63	68.74
Total	1214.48	872.69	341.79

Non-Acquisition of Required Land

341.79 hectare of land, amounting to 28.14 per cent of the total requirement, was yet to be acquired by Railways as of July 2012.

After submission of indents by KRCL/IRCON, the time taken by NRCO in providing the land ranged from 15 to 57 months. Works in the Sangaldan and Khari areas especially, were affected badly due to this delay. To avoid further delay and expenditure on idle manpower/machinery, the contractor had to arrange the land on lease basis from private land owners and claimed ₹ 1.54 crore on account of lease rent paid to the land owners. The lease rentals in regard to lands taken on lease would be additional to the costs of land acquisition.

Analysis by audit revealed that,

- the time taken for obtaining forest clearance ranged from 10 to 56 months;
- due to delayed acquisition/forest clearance, contracts for 8 tunnels and 14 bridges in IRCON portion had to be foreclosed and the progress of works at 12 tunnel sites and 8 bridge sites in KRCL area was hampered by 9 to 35 months.
- due to non finalisation of Final Location Survey in the stretch from Km 31 to 38, Km 53 to 56, Km 58 to 87 and Km 110 to 125, the land requirement could not be identified.

In reply, the Ministry stated that the land acquisition was time-consuming and some works were awarded in anticipation of land being available to meet the tight schedule of completion. In these circumstances, there was no alternative but to foreclose some contracts where land could not be made available. The Ministry further contended that most of the land required was owned by the state government that would be exchanged with those already acquired and now not required. Audit observed that the exchange details were yet to be worked out and the decision of the state government for the exchange proposal was yet to be received. Out of 1214.48 hectares of land acquired so far, 178.16 hectares

became redundant needing exchange/return to the original owners. Audit noticed that out of 93 Kms of route length, which was affected by the realignment, the Final Location Survey in 54.59 Kms. route length was yet to be completed. Hence the complete land indents for these stretches could not be placed.

Lack of adequate planning and a clear time frame for land acquisition/forest clearances contributed to the delay in award of contracts and execution of works and contractor's claims for idle resources.

3.10 Designs and Drawings

Rules envisage that contracts for works should not be awarded unless all plans, drawings and estimates are approved/ sanctioned by the competent authority. Rules also provide that due care is exercised in conducting necessary soil and site investigation before finalisation of design and drawings. For special works, complete sets of drawings should be prepared and made available for reference by the intending tenderers before inviting bids. However, KRCL and IRCON, construction agencies awarded contracts for construction of tunnels and bridges and proof consultancy though the GAD⁷ (General Arrangement Drawings)of the bridges were not ready for the simple reason that the site was still under exploration. In particular, the proof consultancy contracts in respect of Anji and Chenab bridges had to be foreclosed due to non-finalization of designs. In consequence, fresh contracts at higher cost were awarded resulting in an avoidable extra expenditure of ₹ 3.58 crore. Similarly, in the stretch between Banihal and Qazigund (km 164 to km 168) the contracts for retaining walls of formation had to be foreclosed and re-awarded at higher rates resulting in cost over-run of ₹ 26 crore that included extra expenditure of ₹11.67 crore.

The Ministry, in their reply stated that in complex projects drawing and design work cannot be taken up/ completed beforehand and in fact proceeds along with the execution of work. The Ministry however, did not clarify why even GAD were not completed before awarding the contracts but admitted that the design and drawings needed to be revised as the tenders had not incorporated the technical requirements that were later added resulting in change in scope of work.

⁷ 'GAD' refer to the broad parameters of the proposed structure based on which further design/drawing are prepared