

MEMO

Project : -

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To : Whom it may concern

Subject : Danish Railway Infrastructure Budgeting

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In 2006, it was decided politically to restructure the processes for budgeting, budget follow up and budget risk management in public projects within Transportation infrastructure. New principles were described in detail in the so called 'main memo', "*Ny anlægsbudgettering på Transportministeriets område, herunder om økonomi-styringsmodel og risikohåndtering for anlægsprojekter. Version 20. oktober 2010*", in brief "NAB". Referring to the main memo sector specific memos were elaborated for road infrastructure and railway infrastructure budgeting respectively.

This document contains a translation of the official railway memo "*Banenotat, ny anlægsbudgettering på baneområdet. Version 2 af 1. december 2010*" as published by Rail Net Denmark and approved by the Ministry of Transport, Building and Housing. Although in some respects rather historical, the only substance changes introduced by the translation is updating of references to the Rail Net Denmark organisation.

Disclaimer:

This translation is unofficial and made for teaching purposes. Trailc accepts no liability for potential errors, mistakes, inaccuracies, or typos in the translation – but will happily receive comments on such.

Applied terms and abbreviations

Danish term in source text	Applied translated term	Abbreviation
Ankerbudget	Anchor budget	
Aktstykke	Granting legal document	
Anlægslov	Construction act	
Anlægsoverslag	Construction cost estimate	
Anlægsprojekt	New Infrastructure project (can also be functional upgrade of existing)	
Banedanmark	Rail Net Denmark	
Basisoverslag	Basic cost estimate	
Bygherre	Client	
Bygherreleverancer	Client deliveries	
Definitionsfaserapport	Definition phase report	
Departementet	The political administration	
Effektiviseringsopgørelse	Statement of efficiency	
Efterkalkulationsbidrag	Post calculation add-on	PCAO
Efterkalkuleret	Post calculated	
Erfaringspriser	Experienced prices	
Finanslov	State budget	
Forelæggelsesgrænse	Minimum requirement for project submission	
Fornyelsesprojekt	Renewal project	
Fysikbeskrivelse	Physics description	
Fysikoverslag	Physics estimate	
Fysikpost	Physics post	
Hovedentreprise	Main contract	
Korrektionstillæg	Correctional reserve	CR
Licitation	Bid opening	
Mængdefortegnelse	Bill of Quantities	BoQ
Ny anlægsbudgettering (NAB)	New budgeting principles	NBP
Opdragsgiver	Sponsor	
Projektering	Design	
Projekteringslov	Design act	
Tilbud	Bid	
Tilbudsliste (TBL)	Tender Price List	TPL
Tilbuds- og afregningsgrundlag (TAG)	Basis for bidding and payment	BBP
Totalentreprise	Turnkey contract	
Udbud	Tender	
Vurdering af Virkninger på Miljøet (VVM)	Environmental Impact Assessment	EIA
Økonomistyring	Budget management	

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Appendix 2: Establishing of budget

Appendix 3: Anchor budget, renewal

Appendix 4: Updating of construction status

Appendix 5: Transverse costs

Appendix 6: Post structure for new infrastructure projects

Appendix 7: Middle post structure for new infrastructure projects

¹ Appendices are not translated or attached to this document

1 Introduction

This memo describes how The Ministry of Transportation's budget management model for construction projects is implemented in the railway sector. The model includes all new construction projects as well as renewal projects (§ 28.63.05) with a total grant of at least 50 million kr. (minimum requirement for project submission).

In the following a budget management model for the rail sector is described. This shall support the described management initiatives and the main principles from the general model for budget management in construction projects.

The purpose is, furthermore, to ensure a common frame of reference for the construction authority/client and the sponsors.

In the following a distinction is made between new infrastructure projects and renewal projects. The projects are presumed to follow the same management principles but there are differences in the specific tools applied.

The railway memo starts by describing the common overall structure for budget management in the rail sector in terms of data structure and a project phase model.

In section 4 the model of budget management for renewal projects is described with a description of the framework for budgeting, budget risk management, reporting and independent review for each phase in the project. For further description hereof, the reader is referred to appendix 3. Likewise, in section 5 the model for budget management for new infrastructure projects is described.

2 Phase Model

The budget model for the railway sector is based on the phase model described in Rail Net Denmark's management system. The phase model applies to both new infrastructure projects and renewal projects.

The designation and order of the project phases can be seen in the figure below. The content of the different project phases is briefly described as going through the budget management in the individual phase. The phases in the budget model in the rail sector stand out from the phase model that is described in the main memo for new construction budgeting. The relation between the phases in the phase models is described in an appendix to the main memo.



Figure 1 – the project phase model

All project phases take place under the responsibility of Rail Net Denmark. The project can - after political agreeing to a construction act or other decision making - be transferred over to a different client organization than Rail Net Denmark.

In certain cases, there can, after agreeing to a construction act or similar, be a need to carry through further investigations as a roundup of the programme phase. This could, for example, be if the project documentation is to be used as tender basis for a turnkey contract.

3 Common transverse data structure

One of the main purposes of having a new budgeting principles is to establish a data structure, that will ensure traceability from the early basic budgeted estimates (phase 1), through the basic budget estimate (phase 2) and to the implementation (phases 3-5).

The structure can be represented by four levels: main post-, middle post-, post- and under-post level. Though the middle post level is only used in phase 1 for new infrastructure projects.

The structure of the posts incorporates that in the different project phases there is a need to budget at different levels of detail, which is reflected in the fact that there phase 1 is added a correctional reserve of 50 % while there in phase 2 is added a reserve of 30 %. At the same time, it must be possible to conduct budget follow up through the different phases. If a new budgeting principles are to be implemented, it is therefore necessary to apply a common transverse data structure from the time the anchor budget is determined to the time where the final project accounting is made up.

The common transverse data structure is applied through all project phases from the initial budget in the definitions phase to the final project accounting in the closing phase.

The data structure in the overall economy management system applied by Rail Net Denmark, SAP, will make out the most detailed under post level, equivalent to tender price lists, client deliveries, consultant contracts and registering of internal man hours, etc.

The highest level in the post structure is called the main post level. The main posts are equivalent to the traditional structuring of the rail sector in different areas of expertise. See figure 2:

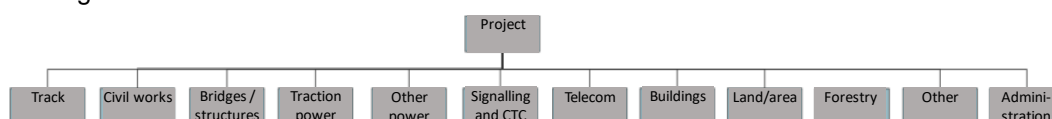


Figure 2 - the main posts in the rail sector

In the introductory phases (1 and 2) work is done at the post level as an aggregative level between the main post level and the under-post level. This post level is an expression of an appropriate planning and budgeting level for the anchor budget. The level of detail and budget accuracy goes hand and hand. An anchor budget that is worked out at post level in project phase 2 is assessed to have an accuracy corresponding to a correctional reserve of 30 %.

The introductory basic budget estimate for new infrastructure projects can be worked out on a more aggregate level, the middle post level. The middle post level reflects the level of knowledge and the budget accuracy for project phase 1 corresponding to a correctional reserve of 50 %.

In renewal project contains, often, one significant main post. Therefore, it is not needed to vary the depth of the planning in the introductory phases. Hence there are three levels in the post structure (see figure 3). For new infrastructure projects, it is in phase 1 possible to plan and budget on the middle post level. The post structure for new infrastructure projects is displayed in figure 4.

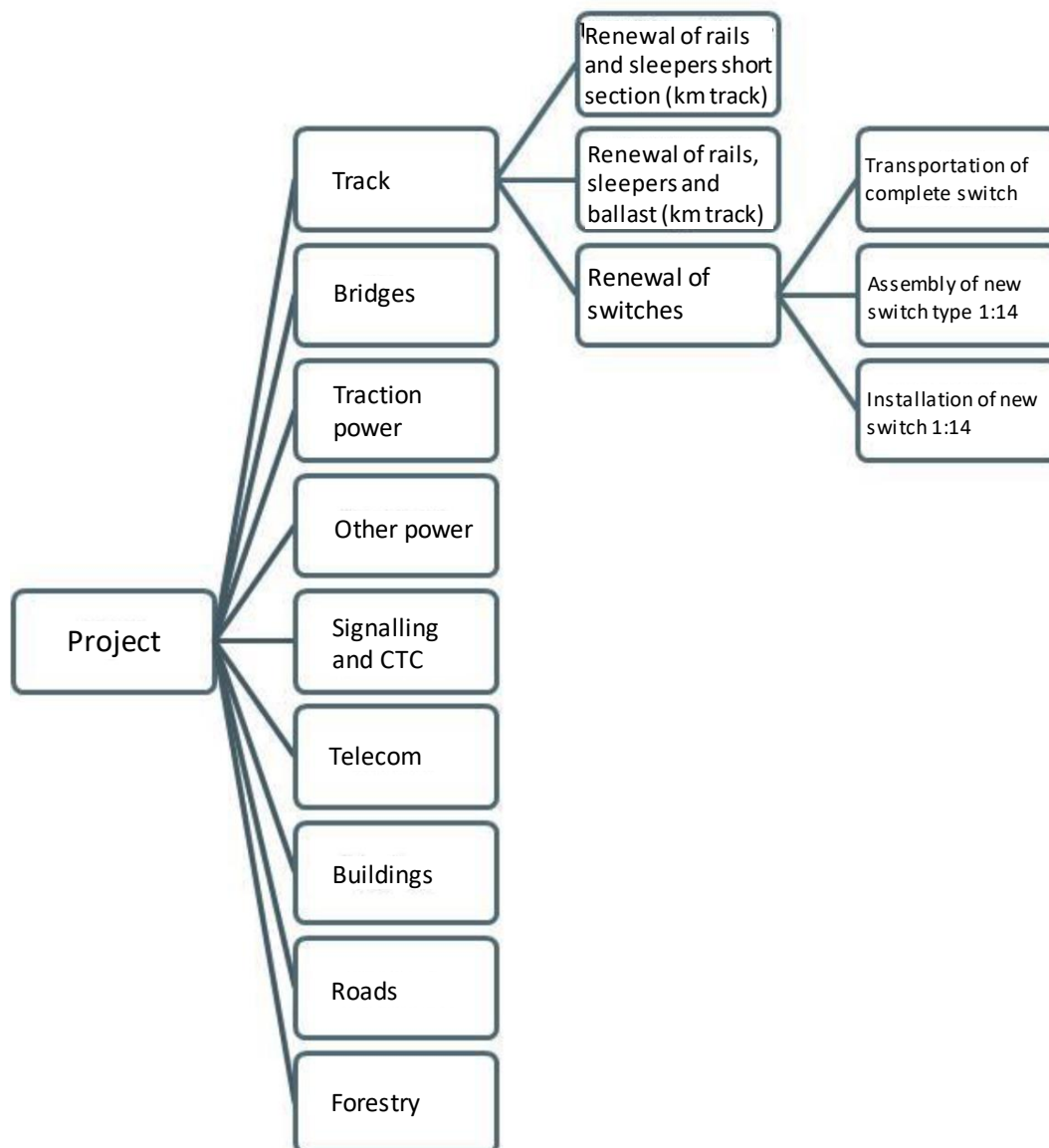


Figure 3 – Extract of draft for the post structure on renewal projects

The collective post structure for all four levels for new infrastructure projects is displayed in appendix 1. The post structure for renewal projects is displayed in appendix 2.

On new infrastructure projects there is, to a large degree, consistency within the various disciplines for all levels in the structure. For renewal projects, the projects can, for the most, be categorized mainly under one main post, but with single elements from other disciplines (for example signaling in a track renewal project).

This means that it will not without caution be possible to use all experienced prices on post level across new infrastructure projects and renewal projects. Rail Net Denmark works to structure a price database so that experienced prices to the largest possible extent can be used across new infrastructure projects and renewal projects. The price database is under development and ready to be used at the end of 2010.

Generally, all experienced prices on post level are based on collection of experienced data from the underlying under-post level (equivalent to standard tender price lists, client deliveries, consultant ATR's, internal man hours, etc.) The common under-post structure ensures a common experience base and constitutes at the same time the key to the traceability in the project budgets.

The common transverse data structure also constitutes the structure for the price and quantity libraries in order to collect prices and quantities for use in the planning of future projects. Prices and quantities will be collected at the lowest level.

The budgeting will, as experience prices are collected for the used posts, be based exclusively on realized projects. In the starting phase, where there are not experienced prices for all posts, it will be necessary to use expert assessments, international benchmarks and similar approaches. The important thing in this regard, is that a documentation of the grounds on which the prices are based, takes place.

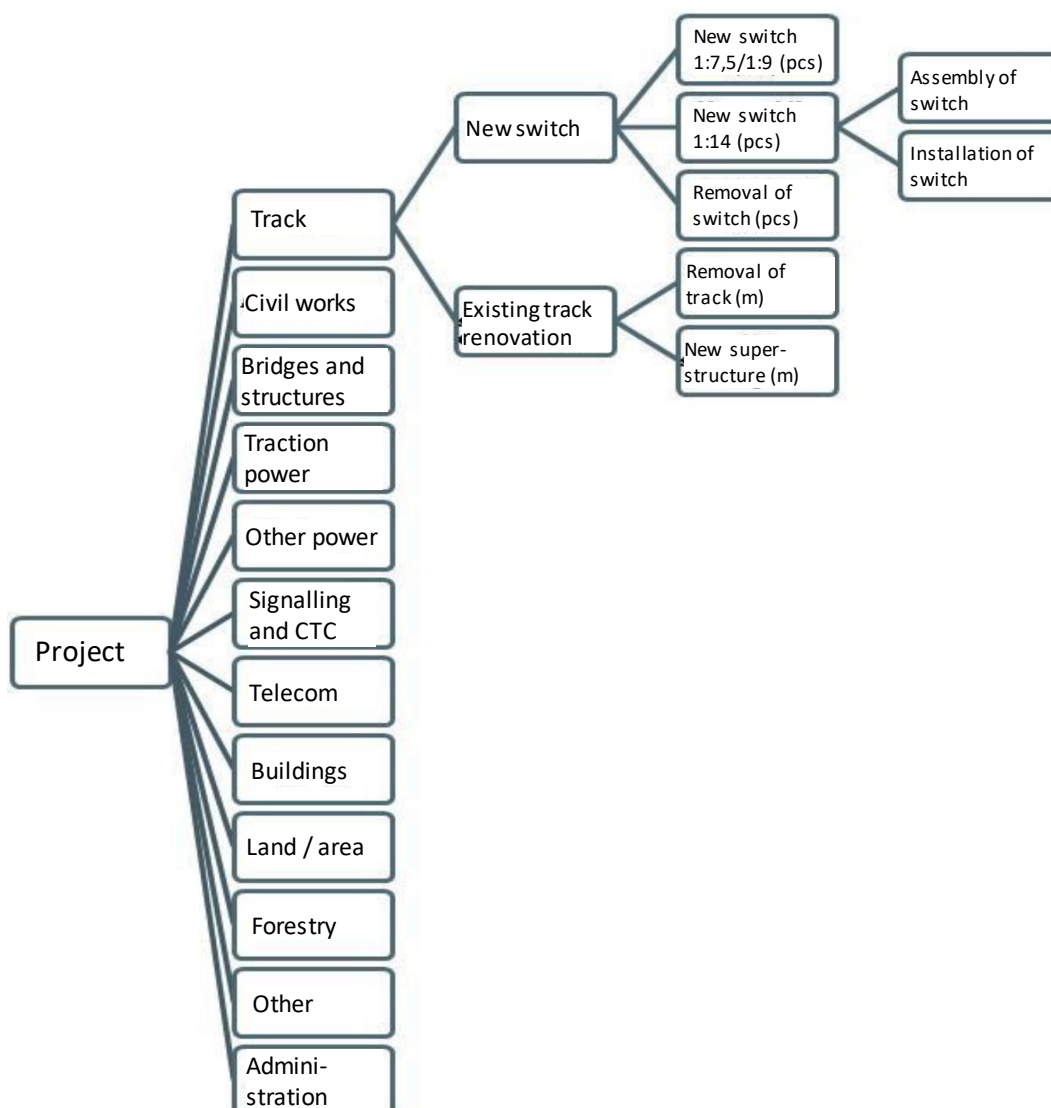


Figure 4 - Part of draft for the post structure on construction projects

3.1 Standard Tender Price Lists (TPL)

There will be developed standard tender price lists where there are:

- Relation between tender price list and the developed tender documents (including definitions and guidelines for the bidders).
- Coordination with the road sector (earth works, bridges, civil structures etc.)

In the renewal project Tinglev-Sønderborg the first version of the standard TPL is worked out for track renewal. By evaluating this list, the standard TPL will be revised. In connection to the completion of other types of projects, similar standard TPL's will be worked out for those project types.

Likewise, there will be developed a standard TPL for new infrastructure projects that will be based on the common transverse data structure.

The standard TPL (including a standard basis for bidding and payment, BBP) have the highest level of detail for the description of the projects. The under-posts in the standard TPL are, in this sense, the building blocks for the more aggregated data structure, that is used in budget calculation.

3.2 Principles for maintaining the Data Structure

An organizational planning unit in Rail Net Denmark will be in charge of maintaining the common transverse data structure in cooperation with the organisational unit that acts as the responsible client which would be “Construction Division” or “Finance and Planning”.

The “Construction Division” is made responsible for developing and maintaining the standard TPL’s. For the signalling discipline, this shall take place in cooperation with the Signalling Programme.

To enable post calculation and collection of experience data to key figures, a data bridge between standard TPL and standard unit prices shall be developed and maintained. Hence all posts in the standard TPL must point to a post in the catalogue of standard unit prices or to a “special post” if not relevant standard unit prices has been defined. The responsibility for maintenance of this data bridge is places at “Finance and Planning” with support from the “Construction Division”.

4 Renewal Projects

Formally, the new budgeting principles is not valid for renewal projects, but it has been decided to use a series of elements from the new budgeting principles for the budgeting and management of the renewal projects as well.

Renewal projects are – unless specified otherwise – financed with a renewal grant, that is divided by technical discipline. The anchor budget for the specific project is established at the end of the programme phase, where the granting legal document is approved. The management principles outlined in this memo include the projects with a budget above the minimum requirement for projects submission to the political body “The Finance Committee”. An underlying guide for budgeting of renewal projects has been developed where the specific elaboration of budget- and risk memo is described.

4.1 Definitions Phase

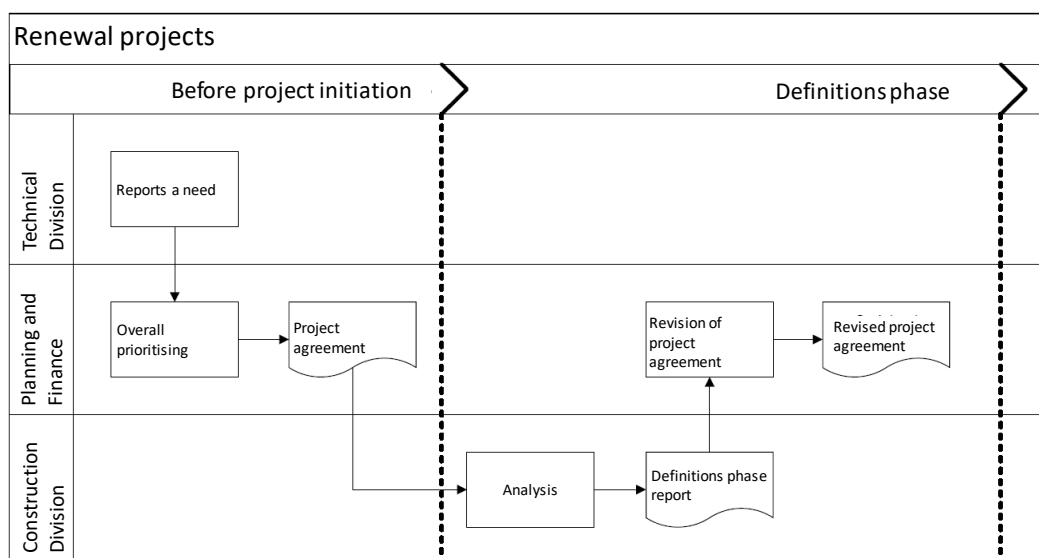


Figure 5 Process flow for budgeting before and in the definitions phase

A renewal project is initiated if the “Technical Division” assesses that there is a need. Together the “Technical Division” and “Planning and Finance” prioritise the specific renewal projects. Hereafter “Planning and Finance” draw up a project agreement with the “Construction Division” for carrying through the renewal project.

The project agreement contains the overall content of the renewal project and initiates the definitions phase of the renewal project. The project agreement also reserves the Construction and Renewal budget for completion of the project, but there is only released means for the definitions phase the programme phase and the design phase.

Depending on the complexity of the project, the “Construction Division” analyses how realistic are the preconditions for the project agreement’s budget, as well as assessing the possibility of any alternative technical solutions. The analyses are summarised in a definition phase report which will be basis for the initiation of the programme phase. The analyses of the “Construction Division” can lead to updating of physical content and

budget expectations after which the project agreement and the affiliated expected grant from the overall state budget renewal post may or may not be updated.

4.1.1 Calculation and Budget Estimate

Track renewal projects have over the past years been calculated and prioritised by use of experienced prices (key figures).

The process for calculation of the project budget is assessed as being well functioning and the method and level of detail, that has been used so far will be continued.

The key figures were originally prepared for the statements of efficiency, that Rail Net Denmark delivers twice per year. The key figures are well defined and built on post calculated prices and quantities from completed projects. The requirement on experience based unit prices in the new budgeting principles are therefore met in such projects.

The application of standard TPL is new for Rail Net Denmark renewal projects. The structure of the standard TPL follow the common transverse data structure as illustrated in figure 2 above.

The key figures include project management, consultancy, supervision and construction site costs. In the definitions phase, there is no independent budgeting of the transverse posts. Such transverse costs budgeting is included from the programme phase.

The structure of the key figures means that they contain elements that deviate from the implementation and technology used for new infrastructure projects. Hence a series of the experienced numbers at the post level cannot be used without caution in budgeting for new infrastructure projects.

There are not experienced numbers for all physics posts in the introductory basic estimate, as shown in appendix 1. For physics posts, that are not repetitive as well as posts where a high degree of assessment is exercised, such as draining and archaeology, it is accepted to operate with "special posts and additions" (sum posts).

The basis of experience for renewal projects will be improved as data are collected with the new standard TPL.

Budget additions for renewal projects in the definitions phase are not used, because such expense estimates are not used for grant estimation, but only for temporary internal prioritising of the renewal works and as basis for decision making in regard to the commencement of the programme phase.

4.1.2 Budget Risk Management

In the definitions phase the project's risk register is initiated. The risk register is maintained continuously throughout the rest of the project (see also appendix 3).

4.1.3 Reporting

The definitions phase brings with it no distinct reporting to the political administration. Internally the definitions phase is reported in a report (or a memo depending on the extent of the project). In the definitions phase report is included a calculated budget for the project, that can give cause for a revision of the budget in the project agreement.

4.1.4 Independent Review

There will not be conducted an external review of renewal projects in the definitions phase.

4.2 Programme Phase

The results of the programme phase are documented in a programme phase report, where, among other things, project cost budget, presumed physical content and other applied budget presumptions are elaborated. Part of the programme phase report is a budget and budget risk memo. The programme phase report is the basis for the granting legal document. The budget as described in the granting legal document will be the anchor budget for the project.

The content and level of detail in the programme phase is, on principle, the same for renewal projects and for new infrastructure projects, taking into account the extent and complexity of the project.

4.2.1 Calculation and Budget Estimate

The programme phase report must comprise a construction cost estimate consisting of a physics cost estimate and quantities. The construction cost estimate is drawn up by detailing and improving on the calculation from the definitions phase. In this phase, there is a special focus on describing the special cost additions that are not included in the physics estimate that can be calculated solely from the key figures. Furthermore, the project's fixed costs, that is the costs for administration, planning, design, supervision construction site etc. are budgeted.

To the construction cost estimate is added a correctional reserve of 10 %, which is included in the anchor budget. When there has been collected experiences from the post calculation of a series of renewal projects, it can be discussed whether to change the correctional reserve.

Post calculation add on (PCAO) There is not used post calculation addition on post level when budgeting for renewal projects, since the PCAO, by default, are assumed included in the key figures.

It will be assessed on a regular basis whether there is a need for PCAO at main post level.

4.2.2 Budget Risk Management

In the programme phase, the risk register established in the definitions phase is detailed and improved, so that it can be used to direct the project manager attention points of special interest regarding budget risks. The formal form of the budget risk analysis is described in appendix 3.

4.2.3 Independent Review

Per default, there will not be made an independent review of renewal projects after the programme phase. Though independent review is a possibility for very large renewal projects. Initiative for such review will be taken by "Planning and Finance" or by the political administration.

4.2.4 Reporting

Reporting from the programme phase consists of the programme phase report and the granting legal document that follows. A template has been drawn up for budget and budget risk memos, which will be sent to the political administration for final elaboration of the granting legal documents. See appendix 3.

4.2.5 Early Tender

Exceptionally, tender for a renewal project comes through already after the programme phase as opposed to after the design phase. This is called “early tender”:

Early tender is used to establish a partner-like cooperation, as the contractor who wins the tender, will subsequently participate in the detailed planning. A derived benefit is that the process is speeded up, because the contractor can begin his mobilisation at an earlier stage. This saves time from the tender and up to the construction phase begins. The tender material is drawn up parallel with the programme phase work. Because of the early time of the tender, the physics estimate will be more uncertain. The entrepreneur contract is as such agreed to on a less well defined basis than at normal tender.

The contractor will take part in the work in the design phase, so a fully planned physics estimate is drawn up before the construction phase begins. Posts in the fully detailed TPL that deviate with >100% from the basis for the contract, must be renegotiated with the contractor.

Early tender is, as such, vulnerable due to lack of detail in the physics estimate and descriptions in the programme phase, which gives the contractor a favourable position for negotiation in regard to the determining of the final basis for payment. On the other hand, there is possibility of incorporating the contractor's ideas and suggestions for work organization, which can lead to a better solution and a more efficient project.

4.3 Design Phase

In the Design Phase the detailed design is done. The project is divided into contracts for tendering, and TPL's for each tender are drawn up.

The Design Phase is initiated with the project manager structuring the project with respect to the defined contracts. The project manager restructures the budget from the key figure based structure, as represented in the anchor budget (see appendix 1) to the contract structure so that each contract will have a proportionate share of the anchor budget associated. There will be a budget bridge leading back to the anchor budget.

The chosen consultants do the detailed design, including the filling out of the standard TPL's with actual physics thus forming contract specific TPL's.

Tender and bid opening is completed and when the result of the bids is known, an intermediate calculation is done. In this calculation, there is a chance to assess the consequence of the realized prices compared to the anchor budget and to assess whether the budget reserves of the project are sufficient. In the assessment is included, if during the Design Phase and the Implementation Phase, there is a realised need for additional works, or if the results of the bids deviate from the expectations.

4.3.1 Budget Risk Management

The reporting table, including documentation for approved changes is updated based on the intermediate calculation.

4.3.2 Reporting

When the tender is completed, the project manager updates the construction estimate, which hereafter is updated based on the achieved bid prices. As mentioned, at the end of the design phase a new budget version is created, which is compared to the anchor budget.

4.4 Implementation Phase

In the implementation phase the project is passed to contract management. The financial contract management will be integrated in SAP (along with PROBAT), while the reporting and comparison with the anchor budget is currently not system supported. A model is applied where the data bridge that is established in connection to the design phase can be maintained and continuously be used as tool for following up on the prognosis and for reporting in the post structure.

4.4.1 Budget Risk Management

After mobilisation, the construction management is responsible for the budget risk management regarding outstanding budget risks from the design phase as well as possible new budget risks identified in the implementation phase.

4.4.2 Reporting

In the implementation phase, the construction management report monthly on progress and prognosis of the project's total expenses in connection to the internal reporting in Rail Net Denmark. It is the project manager responsibility to establish a collective economic overview of the project.

If the prognosis shows significant deviations compared to the latest approved budget version, a formal handling of deviations will take place. The formal handling of deviations will involve reporting in the post structure's format and drawing up of an explanation for the deviation [in the budget] including reporting in the reporting table.

Twice per year the reporting is consolidated in one collective project status that is worked out based on the most current versions of the reporting table. Further, reporting tables shall be sent to the political administration when the project starts using from the 10 percent correctional reserve.

This reporting is valid for all project phases from the design phase and forward for grant legal document projects (renewals) as well as for new infrastructure projects.

For a collective overview of requirements for reporting the reader is directed to the guide from the political administration, appendix 4.

4.5 Closing Phase

In the closing phase, final accountings are drawn up for the individual contracts. The final accountings are consolidated with the internal costs for a collective project accounting. As

such, the project accounting can be used for comparison with the anchor budget and with “budget after bid opening”, the intermediate calculation.

The post-calculation occurs by the project manager making up the following post-calculated posts:

1. The key figure posts, broken down into realised quantities, costs of materials and implementation costs.
2. Fixed costs broken down into project management, consultancy, supervision and construction site costs.
3. Special costs/additions.

The project manager has so far had to give subjective estimates of the key figures, since TPL's and SAP-construction accountings have had a different data structure than the key figures. When there is built a bridge from the standard TPL to the key figures, fixed costs and special costs/additions in SAP, the subjective estimates will be minimised as the post calculation to a large extent can be automated.

When IT-support has been developed for price database and for elaboration of budget estimates it is expected that “Finance and Planning” will be able to generate key figures either by calculating key figures based on all (indexed) experienced data for a key figure or by calculating the key figure based on chosen projects.

5 New Infrastructure Projects

The “Finance and Planning” division in Rail Net Denmark has the responsibility for new infrastructure projects up to the passing of a construction act or other formal decision to go through with the project. From this point the project is handed over to the “Construction Division” or an alternative responsible client.

5.1 Definitions Phase

The definitions phase (preliminary investigations) serves the purpose of assessing whether a project is relevant and (socio economically) profitable to move forward. As such, the purpose is to bring forth a basis for decision making to investigate specific alternatives further.

The decision on initiation of the definitions phase can be come from both the political side, the political administration, and from Rail Net Denmark. The decision of any possible initiation of the definitions phase is made in a dialogue between the political administration and Rail Net Denmark.

Rail Net Denmark works out a proposal for a description of the project with scope and resource requirements. If special requirements are made compared to what is determined in this railway memo, this is described in the project description. This can, for example, be special requirements for budgeting depth, other detailing of the investigations or requirement for further review, other than what is determined in the implementation act 16 of 26th of October 2006. Similarly, the need for external consulting is estimated and it is stated how expenses for this will be financed.

The total process in the definitions phase is illustrated below in figure 6.

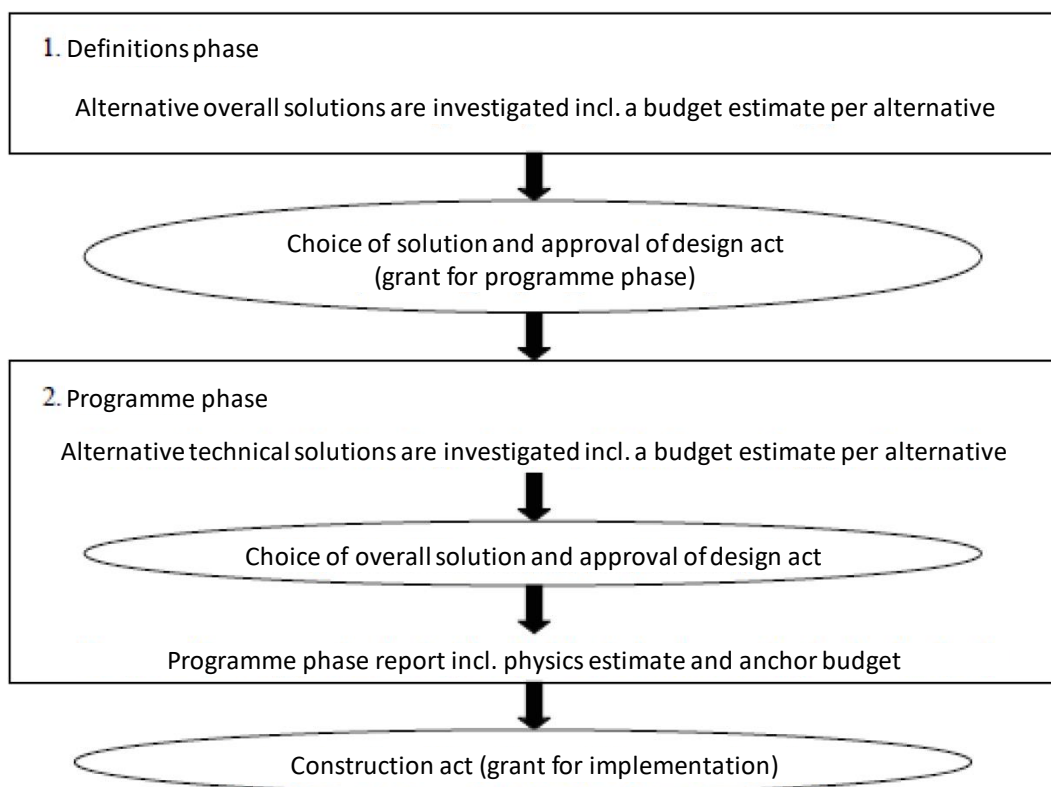


Figure 6 Project process for new infrastructure projects

5.1.1 Calculation and Budget Estimate

Elaboration of the construction cost estimate for the definitions phase shall be based on an overall physics level with extensive use of standard unit prices on middle post level (see appendix 6). The standard unit prices will in a transitional period mostly come from previous consulting estimates that have been exposed to external quality assurance. Only when new infrastructure projects have been finished, there will be applicable experienced data that can be used in the new budget structure.

In relation to this general approach there will be instances where existing experience prices from renewal projects and/or similar experience prices from The Danish Road Directorate can be used to for parts of the budgets for a new infrastructure project. It will be clear from the budget report what the basis for each of the posts is.

On less dominating posts percentages of other physics can be used to estimate the budget. This method can be used in a balancing between quality in the budget, the importance of the post in question and the cost structure in question.

The assessments of the posts that are based on an actual physics description as well as posts that are assessed as percentages of physics will, until experienced data are available, be determined by expert assessments and qualified estimates from specialists in Rail Net Denmark or its' consultants.

To the physics estimate is added a correctional reserve of 50 percent, whereby the total budget estimate for the definitions phase appears.

In case of special circumstances during a project (e.g. special rail possession circumstances) there can be a need to adjust the used unit price compared to the standard unit price. In this case, the correction must be documented for both cause and consequence.

The definition of “special posts” is per default a result of reasoned estimates. Special posts can similarly contain special activities derived from the budget risk analysis (for an in-depth description of the concept “special posts” the reader is directed to the main memo).

5.1.2 Deliveries in the Phase

The definitions phase is ended with a drawing up of a definitions phase report where the alternative overall solutions are described. Furthermore, the reason for prices and quantities is described and the largest budget risks are treated explicitly as for the budget memo and the risk memo in renewal projects.

Furthermore, if necessary (for large projects), a draft is drawn up for the design act and for an act for granting expenses for completion of a possible programme phase.

In the project description, a scope for the programme phase, hereunder special requirements for budgeting depth, technical analyses, review and risk analysis is determined.

At the end of the definitions phase, an estimate for the expenses for the completion of the programme phase is made. This estimate forms the basis for the grant for the programme phase, that is budgeted in connection to the design act.

5.2 Programme Phase

The purpose of the programme phase is to establish a basis for the political decision about whether the project shall be implemented. The programme phase shall, furthermore, form basis for the grant necessary for the construction act or similar formal approval.

The programme phase includes a breaking down and specification of budget preconditions and budget risks compared to the definition phase. The use of resources in the programme phase will be significantly larger than in the definition phase. The specific extent is described in the reporting from the definitions phase and is agreed upon with the political administration when granting design act. There will, as such, always be independent consultants involved, that perform analysis, do design, planning and other clarifications and elaboration of documentation. The project participants at “Finance and Planning” have the primary task of performing project management, coordination, supervision of consultants and servicing of politicians and the political administration.

The programme phase consists in practice of a series of part-phases:

1. Assessment of alternative technical solutions
2. Elaboration of outline proposal or project proposal for an EIA
3. Carrying through of the EIA-process and relevant field investigations

4. Adjustments of project proposal based on the public EIA-hearing.
5. Political approval including grants.
6. Basis for decision making or similar.

It is not all railway projects, that undergo an EIA-process.

In the transferring report to the “Construction Division”, which is a reporting of the work up to and including the project proposal, the requirement specification and the physics are described. Furthermore, the presumptions for the construction estimate are specified.

As such, a part of the design work takes place in the programme phase. However, the detailed design tasks are left for the design phase, along with a composition of the tender documents.

Within certain project types Rail Net Denmark can, with limited effort, choose to let an updated programme phase report form the basis for a turnkey contract. Other projects are not suited for this tender form due to e.g. physical locations, traffic restrictions, multidisciplinary technical complexity or other.

5.2.1 Calculation of Basic Cost Estimate

The basic cost estimate will be drawn up in the fixed post structure, cf. appendix 1. This means, that the physics, from now and forth will be specified in accordance with this post structure.

The used prices will from here on out be based on experienced prices collected from specific completed projects. The prices are collected in a price database for the rail sector supplemented with bid prices and experienced prices from new infrastructure projects at the Danish Road Directorate and secondarily prices from other external projects as well as expert assessments. Rail Net Denmark is the owner of the price database. A template for the drawing up of an anchor budget is given in appendix 1.

In the programme phase a quite extensive design work is undertaken, where a significant specification of the physics take place compared to the level of detail in the definitions phase. Compared to the cost estimate in the definitions phase the physics are specified in the basic cost estimate for the main posts, which in the definitions phase were budgeted with a factor/percentage.

Since the project is designed in the agreed post structure, it will, as experienced prices are collected, be possible to link relevant experienced prices to the individual posts in the budget.

For the main post ‘Signalling and CTC’ standard unit rates are used from the Signalling Programme. To the extent, that actual projects need to rely on existing interlocking technology, there will of course be a need for experienced prices from previous projects. A preparedness will be established in Rail Net Denmark for handling this situation. Given the limited project activity with existing technology it will be the condition up to the end of the Signalling Programme that such experienced prices will be limited to a few types of interlocking technology.

A smaller part of the anchor budget is allocated under “special posts”. These are recognised based on the budget risk assessment or where there is special constructions

that are assessed based on expert estimates or benchmarks. One example could be archaeological works. Also, it could be “provisions” for expenses, that are expected to be held, but where the uncertainty is very high. Sum posts, however, *cannot* be used to cover general risks where a sum is formed by multiplying estimated risk (in percentage) with a calculated budget consequence.

The budget post for project management is budgeted based on estimated full-time equivalents external consultants as well as employees of Rail Net Denmark. The management costs are divided across design, construction management, project management and project administration. Until a solid experience basis has been built up in Rail Net Denmark, the estimate is drawn up based on qualified estimates from Rail Net Denmark and its consultants. The estimate is documented including benchmarks comparing to other similar projects.

Until there has been collected a sufficient amount of experienced prices in the common price database, there will to a large extent be used prices from earlier projects where external quality assurance has been done (as in e.g. the Copenhagen-Ringsted project).

5.2.2 Incorporation of PCAO in Basic Cost Estimate

Physics quantities for building the planned functionality, that hasn't been identified at the time for the drawing up of the basic cost estimate is referred to as “planning gap”. For covering the planning gap one can calculate an experience based post calculation add-on for the relevant posts.

The planning gap appears through a post calculation of a realised project down to the lowest construction element level. The PCAO is covering more construction elements under one; in the rail sector this shall be on main post level.

The size and use of the PCAO will depend on the character of the construction post, since the quantifying is based on realized experiences. A qualified quantification of the planning gap, assumes therefore that one deals with standardized construction work. Through systematic post calculation it will be possible to lay down realistic PCAO percentages.

It must be recognized that instances will occur where there is a need to determine the size of the planning gap without it being possible to determine this on the basis of a complete post calculation. Though, this will only happen in very rare instances, since projects of this kind typically will use “special posts” to a larger degree. As such, it is always required that a thorough description of the considerations and presumptions that forms basis for the size of the post calculation add-on is described. This description can form the basis for a dialogue with the political administration.

It is expected that the relative size of the planning gap (the percentage) will be reduced over the coming years as the result of improved collection of experiences and improved budget risk management.

For the main posts ‘bridges and structures’ and ‘Civil works’ the definition of the PCAO is based on post calculations with the Danish Road Directorate.

5.2.3 Budget risk Management

The budget risk management of the project is begun in the definitions phase where the identified project risks are logged in connection to the project time schedule and construction budget estimate. The budget risk log is updated through the following phases and follows the project all the way through to its accomplishment.

Railway safety considerations are not included in the budget risk management treated in this risk management. Railway safety risks are handled in a separate auspice. Railway safety is, compared to construction budgeting a prerequisite that is dimensioning for the physics.

The budget risk data base includes:

1. All identified budget risks
2. An assessment of budget risk class for each of the identified risks
3. Decided actions to mitigate budget risks

Before the budget estimate in the definitions phase and the basic cost estimate in the programme phase are finished a structured collection and assessment of the project's budget risks is drawn up, cf. figure 7.

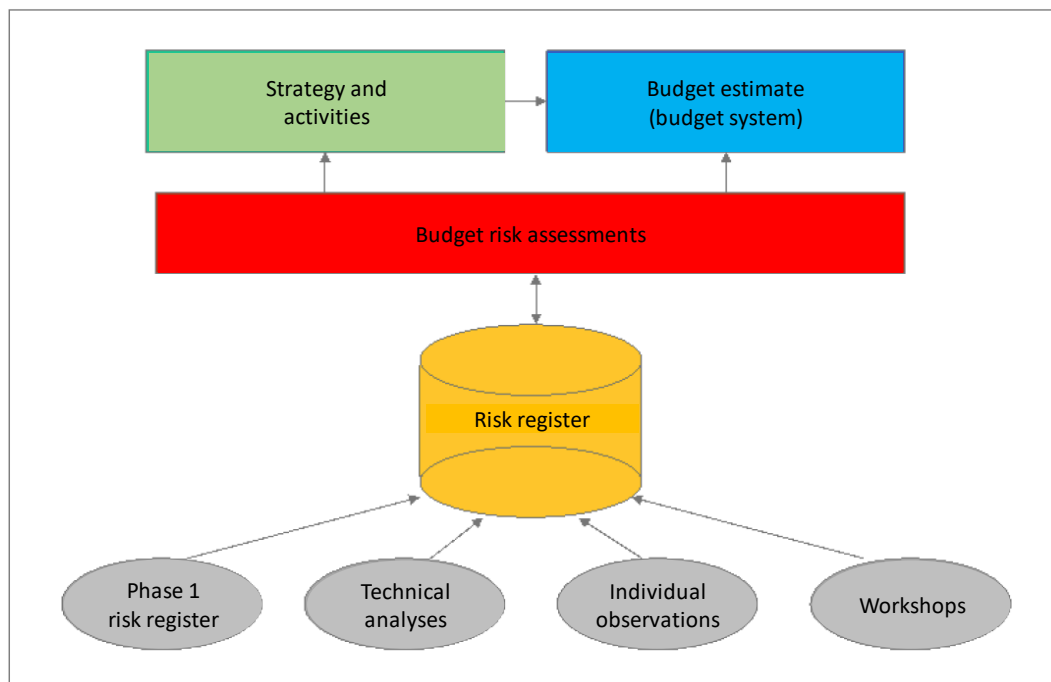


Figure 7 – Budget risk management process.

The identified risks are assessed regarding the following:

- Do the risks in question give reason to reassess the presumed physics with regards to functionality, technology and quantities.
- Do the risks in question give reason to reassess the presumed unit prices?

- Do the risks in question give reason to budget with a sum post, in the case that an expense has to be expected but no valid grounds for quantifying quantity and prices (e.g. archaeology) exist?
- Do the risks in question give reason to initiate and budget with special strategies/activities around the organization of the project, such as tender strategy, soil analyses, extended construction supervision, review and staffing of the project organization?

The budget consequence of an identified risk is expressed as a percentage of the project grant (consequence class). Likewise, the probability that the risk materializes is also expressed as a percentage (probability class). The collective risk class is derived from a combination of the consequence- and probability class, cf. figure 8.

Note that the consequences of a budget risk also can be other than budgetary.

Risk Matrix	Consequence	Insignificant	Small	Moderate	Large	Catastrophic
Probability		< 1 %	1-3 %	3-10 %	10-25 %	>25 %
Almost certain	> 60 %					
Probable	40-59 %					
Possible	20-39 %					
Rare	10-19 %					
Improbable	0-9 %					
Risk class				Low	Moderate	High

Figure 8 – Risk matrix

All identified risks are now gone through to identify possible mitigating measures, as well as measures that can be initiated if the risk materialises. It is noted in the budget risk register, how the different risks are sought to be met. Updating the risk data base happens continuously throughout the life time of the project with any new risks as well as a reassessment of earlier specified risks. A change log is kept, so that it is possible to track *all* changes.

It is recommended that the risk matrix below is used, where the construction authority assesses that the project is of a special character in the form of e.g. size (> 5 bn. kr.), complexity or use of new technology.

Insignificant	Small	Moderate	Large	Catastrophic
< 1 ‰	1 ‰ -1 ‰	1-5 ‰	5-10 ‰	>10 ‰

Table 1 - Consequence classes for projects of special character

5.2.4 Risk reporting at construction status

At construction status to the political administration, the risk analysis is updated through the process mentioned above. In addition to that, for each project at construction status, the most important risks for the project are described qualitatively (in prose).

Depending on the complexity and size of the project, the most important risks are described by “risk class” (High, Moderate, Low), “Plans for handling risks” as well as changes of the most important risks since last construction status, described under “Status relative to last construction status”. The number of described risks can, as such, vary between projects and between reporting’s for the individual project.

In table 2 is given an example of a reporting table for the construction status.

Description of risk	Risk class	Plans for handling risk	Status relative to last construction status
<i>Description of risk</i>	<i>See assessment completed in compliance with NBP requirements.</i>	<i>Description of risk mitigating actions. Examples: - Cannot be influenced (market terms) - Intensified focus on QA - Occured, entered into budget on post number X (financed by reserve) - change of budget.</i>	<i>Unchanged, new, adjusted upwards, adjusted downwards</i>
Risk for higher volume of additional work than presumed.	High	No immediate action. Must await detailed design and the opportunity for detailed calculation of quantities that follows. By contracting a systematical walk through of the project is completed with the contractor.	Unchanged
Poor cooperation between client, consultant and contractor.	Moderate	Tender material indicates that importance is given to cooperation. Supervision plan carefully describes the plan to cooperate. Supervision seminar is held with a focus on cooperating. Weekly planning meetings. Supervision and contractor is placed together on the site office.	Adjusted downwards (from high)

Table 2 - Example of reporting table for construction status

5.2.5 Price regulation

In new infrastructure projects budget index regulation is either done through a general index (typically the construction index) or through a more detailed regulation, where the relevant index on post level is decided upon. The latter model was first implemented in the Copenhagen-Ringsted project, (although not on consequently on post-level). Rail Net Denmark specifically assesses for the individual projects if a general or specific indexes shall be used depending on the content of the project and the experience basis for the underlying prices. The assessment is made in a dialogue with the political administration.

For the reporting of the budgeting to the general state budget the reader is directed to a memo about the budgeting of new infrastructure projects in the general state budget (work in progress).

5.2.6 Reporting

The requirements for reporting to the political administration etc. are given in the Ministry’s guide, see appendix 4.

5.2.7 Independent Review

An independent review of the basic cost estimate must be done for projects with a total cost greater than 250 mio. kr. The political administration can put forth requirements for further reviews during the programme phase.

5.3 Design Phase

The design phase is typically managed by Rail Net Denmark. For larger new infrastructure projects, there can be established an independent client organization as for example Sund & Bælt. Derived changes in the budget management process in such cases are not described in this memo.

The detailed design and the drawing up of tender documents is an integrated process in the rail sector since clarifications with the authorities to a large extent has been made in the programme phase.

5.3.1 Calculation and Budget Estimate

At the start of the design phase, a budget version is used, that reflects the anchor budget. Content wise it is a copy of the construction cost estimate that formed the basis for the construction act.

During the design phase the physics on under-post level is specified and the budget is split on contracts corresponding to the tender structure. On larger projects this will take place stepwise for the different main posts. Typically, the call for tenders for e.g. civil works will be completed before the design work and the drawing up of standard TPL's is completed for e.g. signalling or traction power.

The design phase will on an on-going basis result in a series of TPL's for the project contracts. The TPL's will contain the designed quantities. A data bridge is established between the anchor budget's post level and the under posts level that is established in the design phase. For handling this, the reader is referred to a guide for updating the reporting schedule.

In practice, years can pass between the first and the last calls for tenders. For these projects, regarding the budget versions, that form the basis for the semi-annual status reports to the political administration, it must be documented which posts rely on estimates and agreed-upon contracts respectively. For each agreed upon contract a middle calculation will be done, and there will be drawn up a revised reporting schedule, and, if required, a new formal budget version including significant changes.

5.3.2 Budget Risk Management

The project continues the budget risk management from the previous phases. The extent of the budget risk management should be assessed regarding the project's economic size and its complexity. As a minimum, budget risk management must be completed in the same way as for renewal projects (earlier described in the memo). That is, identified budget risks must be assessed regarding probability and consequence and with description of mitigating actions as well as considerations about handling thereof.

5.3.3 Reporting

Rail Net Denmark must for every new infrastructure project draw up a semi-annual status report for the political administration. The report is described in the guide from the Ministry, see appendix 4. At the reporting, changes must be explained in the defined categories for project changes as follows:

Category	Explanation
Project organisation	<p>The category contains changes that relate to competencies and capacity and can, among other things, be caused by inadequate design. The changes can also be caused by inadequate staffing and hereby a lack of competencies at client, consultants, suppliers or contractors during design and execution. Finally, the changes can be caused by a lack of internal communication in the project organisation.</p> <p>The changes can furthermore be caused by mistakes and lacks in the basis that has formed the foundation for the political approval of the project. Finally, changes that are a result of the tender and strategy fall under this category. Changes as a result of inadequate supervision during the construction period also fall under this category.</p>
Technical factors	<p>The category contains changes resulting from changed conditions in the design phase and in the implementation phase. This can among other things be caused by changed quantities, changed geometry/ construction design, drainage works, cable relocation works, earth works, traction power works, signalling works, track works etc. Of the changes following from earth works can among other things be mentioned polluted soil, soft ground, unexpected soil conditions etc. The category also covers cable breaches, utility relocations as well as unknown hidden conditions such as hidden cables and utilities, track condition or other old technology.</p> <p>Changes as a result of extreme weather also fall under this category as well as changes resulting from implementation work, technical migration, operational disturbances as well as equipment/vehicle breakdowns and larger incidents and costs this regard.</p> <p>To the category belongs furthermore changes resulting from technical interfaces both internally and externally, requirement and scope, technical tender material, necessary updates, traffic regulatory measures.</p> <p>In addition to this, interpretations and claims from contractors during the implementation phase also falls under this category.</p>
Market and external conditions	<p>The category contains changes resulting from extraneous conditions, hereunder, among other things, market and competition, evaluation of the incoming bids hereunder procedures and complaints, neglect of contracts as well as lawful economic disputes (hereunder interpretation of claims from contractors).</p> <p>Extraordinary price developments for e.g. commodities and salaries also fall under this category as well as changes in costs for contractors. Such changes must be in exceedance the normal price development. Finally, changes resulting from costs for compensations belong in this category. Compensations can, among other things, cover damages to roads or property.</p>

Category	Explanation
Authority regulations	<p>The category includes changes resulting from (new) regulation requirement from public authorities. This can among other things be political or municipal requirements for a specific project implementation changed laws or safety requirements for the finished infrastructure, land use understood as acquiring of land, property and archaeology.</p> <p>Changes resulting from requirements for environmental approvals, hereunder Natura 2000 areas, habitat areas, fauna passages and measures against climate changes and noise (coating, noise screens, noise barriers) also fall under this category as well as changes because of other legal factors.</p>

5.3.4 Independent Review

There is no need for external review after the design phase, as the up-to-date prices will now be known.

5.4 Implementation Phase

Budget management in the implementation phase consists of contract management. The report for the political administration is the same, as for the design phase.

External review is not done in the implementation phase, unless extraordinary deviations arise that give the political administration cause to initiate an extra external review.

Continuous follow up regarding the contractor deliveries is done. This comprise indication of realized works and expected extra works, so that an up to date prognosis for the total economy in each contract can be done on a monthly basis.

Further, an ongoing estimation of expenses for consultants as well as expenses for internal resources in Rail Net Denmark is done throughout the implementation phase.

5.5 Closing Phase

The central task of the closing phase is the post calculation of the project and the drawing up of a construction accounting. The construction accounting is not dealt with in this memo. The post calculations have the following purposes:

1. Collection of experience and evaluation
2. Generation of experienced data for the price database.
3. Evaluation of the post calculation add-on.

In the post calculation the realized expenses are compared with the basic cost estimate for the respective contracts. Reasons for significant deviations are explained and documented.

The allocation of expenses from under-post level to post level (standard unit prices and special posts) is expected to mostly happen through mapping as a result of the earlier described “data bridge”. In practice, there will arise e.g. extra works, which the data bridge cannot account for. In these cases, the project management will do a manual allocation of realized expenses for the post level. In this relation, it can be necessary to establish new “special posts” in relation to the anchor budget – technically, this can happen throughout the whole course from the design phase to the closing phase.

The deviations, that are identified at the post calculation are analysed. The reason for the deviation within the identified categories is determined (see above).

After that, every project will be part of an assessment, whether there is need to adjust the size of the correctional reserve and possibly also post calculation add-ons where relevant.

Appendices

[Not translated]