

# concept

James Odeck, Maria Bratt Börjesson,  
Johanna Jussila Hammes,  
Gro Holst Volden and Morten Welde

What characterises road projects with a positive value for money? A study based on data from national transport plans in Norway and Sweden

Concept report no. 70



transport  
concept

James Odeck, Maria Bratt Börjesson,  
Johanna Jussila Hammes,  
Gro Holst Volden and Morten Welde

**What characterises road  
projects with a positive value  
for money? A study based on  
data from national transport  
plans in Norway and Sweden**

Concept report no. 70

Concept report no. 70

## **What characterises road projects with a positive value for money? A study based on data from national transport plans in Norway and Sweden**

James Odeck<sup>1</sup>, Maria Bratt Börjesson<sup>2</sup>, Johanna Jussila Hammes<sup>2</sup>, Gro Holst Volden<sup>3</sup> and Morten Welde<sup>3</sup>

*<sup>1</sup>Norwegian Public Roads Administration / Norwegian University of Science and Technology, <sup>2</sup>Swedish National Road and Transport Research Institute (VTI), <sup>3</sup>Norwegian University of Science and Technology*

ISSN: 0803-9763 (paper version)

ISSN: 0804-5585 (web version)

ISBN: 978-82-8433-034-1 (paper version)

ISBN: 978-82-8433-035-8 (web version)

© Concept Research Programme. The publication may be quoted freely with attribution.

DATE: March 2023

PUBLISHER: Ex Ante Academic Publisher

Concept Research Programme  
Norwegian University of Science and Technology  
7491 NTNU – Trondheim  
Norway  
[www.ntnu.no/concept](http://www.ntnu.no/concept)

The responsibility for the information in the reports produced on behalf of the Concept Research Programme is on the commissioned party. Views and conclusions are on account of the authors and are not necessarily identical to the views of the Concept Research Programme. All contributions are reviewed in a peer review process.

## English summary

This study investigates the factors that characterize road projects with high value for money. Our point of departure for the study is that such elements can be identified at an early stage of project generation before conducting a thorough cost-benefit analysis. Thus, one can avoid further developing and political lock-in to projects that subsequently lead to the loss of society's resources at the expense of other potentially profitable projects. Although the issue is crucial, few published studies have investigated this as thoroughly as we do here. Moreover, the studies that examined the issue have yet to analyze data from two countries combined and highlight differences between the countries. Therefore, our study's results significantly contribute to the international research literature.

We have used data from cost-benefit calculations from Norway and Sweden. The calculations are those made in connection with the countries' national transport plans (NTP), where the data for Norway are from the National Transport Plan 2018-2029. Sweden's data set is from three different planning periods: NTP 2010-2021, 2014-2025, and 2018-2029. The number of observations we started with is extensive and included 1119 projects collected from both countries. In addition, we have obtained data on geographical and other project-specific characteristics, such as whether the project is located in a city, whether the project is centrally located, and population density. We have obtained this information from the countries' statistical agencies and other institutions that hold such data.

However, we have only used the monetized part of the cost-benefit analysis in the study. An adequate cost-benefit analysis should include both the monetized and the non-monetized impacts. The results could have differed if the non-monetized part also had been included. Similarly, one should gather information about the project's contribution to different political goals and distributional impacts to assess them from an even broader perspective. However, both Norway and Sweden mainly present data on the monetized impacts of their national transport plans. With that caveat, however, monetized impacts contain many decision-relevant aspects that indicate where a project is headed concerning value for money. Thus, our results have a high degree of validity.

Norway and Sweden are relatively similar in implementing cost-benefit analysis, parameter values, and other factors included in the analyses, as well as the planning processes leading up to prioritizing road projects in national transport plans. Given the similarities between the countries, we merged the data sets from both countries and analyzed them together. It also meant that we could test other secondary yet interesting hypotheses in demand. Among other things, we have tested hypotheses about whether Swedish projects are more profitable than Norwegian projects, which factors can explain the difference, and whether large projects are more profitable than projects that cost less. The latter hypothesis must be especially interesting to Norway since there has been a focus on developing larger projects (longer stretches of roads) in recent years with the expectation that they generate more considerable net benefits than smaller projects.

We use robust regression analysis to test our main research questions. We investigate which project-specific characteristics affect the net benefit (NNB) and the likelihood that the projects will be profitable. In order to test the differences in the samples concerning certain factors, such as the profitability of Norwegian versus Swedish projects, we have used the Wilcoxon Rank-Sum test, which is well-suited for analyzing hypotheses of this type.

The study is organized stepwise and in chapters enabling readers to choose what they want to focus on in addition to the emerging results. Chapter 1 provides an introduction where we argue about the need for the study and explain the chosen approach. Chapter 2 is a literature review that refers to related studies and concludes with the need for the present study. Chapter 3 discusses current cost-benefit analysis models, calculation assumptions, and the planning and decision-making process for road projects in Norway and Sweden. We argue that Norway and Sweden are comparable and document comparability. Chapter 4 describes the method and data set used and clarifies the research questions and hypotheses we test later. Chapter 5 presents the results, while Chapter 6 highlights the main conclusions, discuss their implications, and points out potential topics for future studies.

The main results of this study can be summarized as follows:

1. Swedish road projects have a significantly higher value for money than Norwegian projects. The portfolio of Norwegian projects has very few projects with positive profitability compared to Swedish projects.

2. Important reasons for this are that, on average and with statistical significance, Swedish projects have a higher traffic base and lower investment cost (per km of road) than Norwegian projects.
3. The profitability of projects measured by net benefit per budget dollar (NNB) for small projects is significantly higher than for large projects, regardless of the country. This result must be remarkable for Norway, where there is an increasing focus on developing longer stretches of roads and preferably four-lane highways.
4. Concerning our main questions, we find the following characteristics that can be used in the early phase to weed out projects that are not expected to be profitable. These can also be used later in the optimization process to identify potential areas where costs can be cut, and benefits can be increased:
  - (i) Traffic measured by ÅDT increases both benefits and costs. The overall effect on profitability is slightly positive but significant. We also observe that NNB only becomes positive when ÅDT reaches approximately 6,000 vehicles. Most of the projects in the sample have less traffic than this.
  - (ii) Furthermore, centrality, measured by proximity to a city or town, positively affects profitability. On the other hand, it is expensive to build in cities, and the variable population density, therefore, has, in isolation, a negative effect on profitability. These two results can imply that it is profitable to improve the accessibility of a nearby city but not to build in the city center itself.
  - (iii) Projects in municipalities with a high-income level are more profitable than others. In theory, this is logical as the time value is assumed to increase with income. However, the mechanisms at play could be clearer, as the data we have used are national average values for time.
  - (iv) Local funding contributions (in Norway, typically tolls) have a slightly negative effect on profitability. Here, different mechanisms may work in different directions, but there are strong indications that the efficiency loss effect that reduces benefits predominates.

Finally, the report discusses how the results can be used in the early phase of project planning and in the optimization phase to ensure that the most profitable projects are selected and taken forward. It is emphasized that efforts should be made to include the non-monetized impacts and a broader target picture than profitability in the overall decision basis. Later research projects

should, among other things, look more closely at why the cost per kilometer of road for Norwegian projects is much higher than for Swedish projects. Both countries would benefit from such a comparison and learn from each other about how investment costs can be reduced to increase the social benefit of projects.

## Concept report series

Paper version: ISSN 0803-9763

Web version: ISSN 0804-5585

Norwegian version: <https://www.ntnu.no/concept/concept-rapportserie>

English version: <https://www.ntnu.edu/concept/concept-report-series>

Report	Title	Author (-s)
No 1	Styring av prosjektporteføljer i staten. Usikkerhetsavsetning på porteføljenivå <i>Project Portfolio Management. Estimating Provisions for Uncertainty at Portfolio Level.</i>	Stein Berntsen and Thorleif Sunde
No 2	Statlig styring av prosjektledelse. Empiri og økonomiske prinsipper. <i>Economic Incentives in Public Project Management</i>	Dag Morten Dalen, Ola Lædre and Christian Riis
No 3	Beslutningsunderlag og beslutninger i store statlige investeringsprosjekt <i>Decisions and the Basis for Decisions in Major Public Investment Projects</i>	Stein V. Larsen, Eilif Holte and Sverre Haanæs
No 4	Konseptutvikling og evaluering i store statlige investeringsprosjekt <i>Concept Development and Evaluation in Major Public Investment Projects</i>	Hege Gry Solheim, Erik Dammen, Håvard O. Skaldebø, Eystein Myking, Elisabeth K. Svendsen and Paul Torgersen
No 5	Bedre behovsanalyser. Erfaringer og anbefalinger om behovsanalyser i store offentlige investeringsprosjekt <i>Needs Analysis in Major Public Investment Projects. Lessons and Recommendations</i>	Petter Næss
No 6	Målformulering i store statlige investeringsprosjekt <i>Alignment of Objectives in Major Public Investment Projects</i>	Ole Jonny Klakegg
No 7	Hvordan tror vi at det blir? Effektvurderinger av store offentlige prosjekter <i>Up-front Conjecture of Anticipated Effects of Major Public Investment Projects</i>	Nils Olsson
No 8	Realopsjoner og fleksibilitet i store offentlige investeringsprosjekt	Kjell Arne Brekke



Report	Title	Author (-s)
	<i>Real Options and Flexibility in Major Public Investment Projects</i>	
No 9	Bedre utforming av store offentlige investeringsprosjekter. Vurdering av behov, mål og effekt i tidligfasen  <i>Improved Design of Public Investment Projects. Up-front Appraisal of Needs, Objectives and Effects</i>	Petter Næss med bidrag fra Kjell Arne Brekke, Nils Olsson and Ole Jonny Klakegg
No 10	Usikkerhetsanalyse – Kontekst og grunnlag  <i>Uncertainty Analysis – Context and Foundations</i>	Kjell Austeng, Olav Torp, Jon Terje Midtbø, Ingemund Jordanger, and Ole M Magnussen
No 11	Usikkerhetsanalyse – Modellering, estimering og beregning  <i>Uncertainty Analysis – Modeling, Estimation and Calculation</i>	Frode Drevland, Kjell Austeng and Olav Torp
No 12	Metoder for usikkerhetsanalyse  <i>Uncertainty Analysis – Methodology</i>	Kjell Austeng, Jon Terje Midtbø, Vidar Helland, Olav Torp and Ingemund Jordanger
No 13	Usikkerhetsanalyse – Feilkilder i metode og beregning  <i>Uncertainty Analysis – Methodological Errors in Data and Analysis</i>	Kjell Austeng, Vibeke Binz and Frode Drevland
No 14	Positiv usikkerhet og økt verdiskaping  <i>Positive Uncertainty and Increasing Return on Investments</i>	Ingemund Jordanger
No 15	Kostnadsusikkerhet i store statlige investeringsprosjekter; Empiriske studier basert på KS2  <i>Cost Uncertainty in Large Public Investment Projects. Empirical Studies</i>	Olav Torp (red.), Ole M Magnussen, Nils Olsson and Ole Jonny Klakegg
No 16	Kontrahering i prosjektets tidligfase. Forsvarets anskaffelser.  <i>Procurement in a Project's Early Phases. Defence Aquisitions</i>	Erik N. Warberg
No 17	Beslutninger på svakt informasjonsgrunnlag. Tilnærminger og utfordringer i prosjekters tidlige fase	Kjell Sunnevåg (red.)

Report	Title	Author (-s)
	<i>Decisions Based on Scant Information. Challenges and Tools During the Front-end Phases of Projects</i>	
No 18	Flermålsanalyser i store statlige investeringsprosjekt  <i>Multi-Criteria Decision Analysis In Major Public Investment Projects</i>	Ingemund Jordanger, Stein Malerud, Harald Minken and Arvid Strand
No 19	Effektvurdering av store statlige investeringsprosjekter  <i>Impact Assessment of Major Public Investment Projects</i>	Bjørn Andersen, Svein Bråthen, Tom Fagerhaug, Ola Nafstad, Petter Næss and Nils Olsson
No 20	Investorers vurdering av prosjekters godhet  <i>Investors' Appraisal of Project Feasibility</i>	Nils Olsson, Stein Frydenberg, Erik W. Jakobsen, Svein Jessen, Roger Sørheim and Lillian Waagø
No 21	Logisk minimalisme, rasjonalitet - og de avgjørende valg  <i>Major Projects: Logical Minimalism, Rationality and Grand Choices</i>	Knut Samset, Arvid Strand and Vincent F. Hendricks
No 22	Miljøøkonomi og samfunnsøkonomisk lønnsomhet  <i>Environmental Economics and Economic Viability</i>	Kåre P. Hagen
No 23	The Norwegian Front-End Governance Regime of Major Public Projects – A Theoretically Based Analysis and Evaluation	Tom Christensen
No 24	Markedsorienterte styringsmetoder i miljøpolitikken  <i>Market oriented approaches to environmental policy</i>	Kåre P. Hagen
No 25	Regime for planlegging og beslutning i sykehusprosjekter  <i>Planning and Decision Making in Hospital Projects. Lessons with the Norwegian Governance Scheme.</i>	Asmund Myrbostad, Tarald Rohde, Pål Martinussen and Marte Lauvsnes
No 26	Politisk styring, lokal rasjonalitet og komplekse koalisjoner. Tidligfaseprosessen i store offentlige investeringsprosjekter	Erik Whist and Tom Christensen

Report	Title	Author (-s)
	<i>Political Control, Local Rationality and Complex Coalitions. Focus on the Front-End of Large Public Investment Projects</i>	
No 27	Verdsetting av fremtiden. Tidshorisont og diskonteringsrenter  <i>Valuing the future. Time Horizon and Discount Rates</i>	Kåre P. Hagen
No 28	Fjorden, byen og operaen. En evaluering av Bjørvikautbyggingen i et beslutningsteoretisk perspektiv <i>The Fjord, the City and the Opera. An Evaluation of Bjørvika Urban Development</i>	Erik Whist and Tom Christensen
No 29	Levedyktighet og investeringstiltak. Erfaringer fra kvalitetssikring av statlige investeringsprosjekter  <i>Sustainability and Public Investments. Lessons from Major Public Investment Projects</i>	Ola Lædre, Gro Holst Volden and Tore Haavaldsen
No 30	Ettrevaluering av statlige investeringsprosjekter. Konklusjoner, erfaringer og råd basert på pilotevaluering av fire prosjekter  <i>Evaluating Public Investment Projects. Lessons and Advice from a Meta-Evaluation of Four Projects</i>	Gro Holst Volden and Knut Samset
No 31	Store statlige investeringers betydning for konkurranse- og markedsutviklingen. Håndtering av konkurransemessige problemstillinger i utredningsfasen  <i>Major Public Investments' Impact on Competition. How to Deal with Competition Issues as Part of the Project Appraisal</i>	Asbjørn Englund, Harald Bergh, Aleksander Møll and Ove Skaug Halsos
No 32	Analyse av systematisk usikkerhet i norsk økonomi.  <i>Analysis of Systematic Uncertainty in the Norwegian Economy.</i>	Haakon Vennemo, Michael Hoel and Henning Wahlquist
No 33	Planprosesser, beregningsverktøy og bruk av nytte-kostnadsanalyser i vegsektoren. En sammenlikning av praksis i Norge og Sverige.  <i>Planning, Analytic Tools and the Use of Cost-Benefit Analysis in the Transport Sector in Norway and Sweden.</i>	Morten Welde, Jonas Eliasson, James Odeck and Maria Börjesson

Report	Title	Author (-s)
No 34	Mulighetsrommet. En studie om konseptutredninger og konseptvalg <i>The Opportunity Space. A Study of Conceptual Appraisals and the Choice of Conceptual Solutions.</i>	Knut Samset, Bjørn Andersen and Kjell Austeng
No 35	Statens prosjektmodell. Bedre kostnadsstyring. Erfaringer med de første investeringstiltakene som har vært gjennom ekstern kvalitetssikring	Knut Samset and Gro Holst Volden
No 36	Investing for Impact. Lessons with the Norwegian State Project Model and the First Investment Projects that Have Been Subjected to External Quality Assurance	Knut Samset and Gro Holst Volden
No 37	Bruk av karbonpriser i praktiske samfunnsøkonomiske analyser. En oversikt over praksis fra analyser av statlige investeringsprosjekter under KVVU-/KS1-ordningen. <i>Use of Carbon Prices in Cost-Benefit Analysis. Practices in Project Appraisals of Major Public Investment Projects under the Norwegian State Project Model</i>	Gro Holst Volden
No 38	Ikke-prissatte virkninger i samfunnsøkonomisk analyse. Praksis og erfaringer i statlige investeringsprosjekter <i>Non-Monetized Impacts in Economic Analysis. Practice and Lessons from Public Investment Projects</i>	Heidi Bull-Berg, Gro Holst Volden and Inger Lise Tyholt Grindvoll
No 39	Lav prising – store valg. En studie av underestimering av kostnader i prosjekters tidligfase <i>Low estimates – high stakes. A study of underestimation of costs in projects' earliest phase</i>	Morten Welde, Knut Samset, Bjørn Andersen and Kjell Austeng
No 40	Mot sin hensikt. Perverse incentiver – om offentlige investerings-prosjekter som ikke forplikter <i>Perverse incentives and counterproductive investments. Public funding without liabilities for the recipients</i>	Knut Samset, Gro Holst Volden, Morten Welde and Heidi Bull-Berg
No 41	Transportmodeller på randen. En utforsking av NTM5-modellens anvendelsesområde	Christian Steinsland and Lasse Fridstrøm

Report	Title	Author (-s)
	<i>Transport models and extreme scenarios. A test of the NTM5 model</i>	
No 42	Brukeravgifter i veisektoren <i>User fees in the road sector</i>	Kåre Petter Hagen and Karl Rolf Pedersen
No 43	Norsk vegplanlegging: Hvilke hensyn styrer anbefalingene <i>Road Planning in Norway: What governs the selection of projects?</i>	Arvid Strand, Silvia Olsen, Merethe Dotterud Leiren and Askill Harkjerr Halse
No 44	Ressursbruk i transportsektoren – noen mulige forbedringer <i>Resource allocation in the transport sector – some potential improvements</i>	James Odeck (ed.) and Morten Welde (ed.)
No 45	Kommunale investeringsprosjekter. Prosjektmodeller og krav til beslutningsunderlag. <i>Municipal investment practices in Norway</i>	Morten Welde, Jostein Aksdal and Inger Lise Tyholt Grindvoll
No 46	Styringsregimer for store offentlige prosjekter. En sammenliknende studie av prinsipper og praksis i seks land. <i>Governance schemes for major public investment projects: A comparative study of principles and practices in six countries</i>	Knut F. Samsset, Gro Holst Volden, Nils Olsson and Eirik Vårdal Kvalheim
No 47	Governance Schemes for Major Public Investment Projects. A comparative study of principles and practices in six countries.	Knut F. Samsset, Gro Holst Volden, Nils Olsson and Eirik Vårdal Kvalheim
No 48	Investeringsprosjekter og miljøkonsekvenser. En antologi med bidrag fra 16 forskere. <i>Environmental Impact of Large Investment Projects. An Anthology by 16 Norwegian Experts.</i>	Kåre P. Hagen and Gro Holst Volden
No 49	Finansiering av vegprosjekter med bompenger. Behandling av og konsekvenser av bompenger i samfunnsøkonomiske analyser. <i>Financing road projects with tolls. The treatment of and consequences of tolls in cost benefit analyses.</i>	Morten Welde, Svein Bråthen, Jens Rekdal and Wei Zhang
No 50	Prosjektmodeller og prosjekteierstyring i statlige virksomheter.	Bjørn Andersen, Eirik Vårdal Kvalheim and Gro Holst Volden

Report	Title	Author (-s)
	<i>Project governance and the use of project models in public agencies and line ministries in Norway.</i>	
No 51	Kostnadskontroll i store statlige investeringer underlagt ordningen med ekstern kvalitetssikring.  <i>Cost performance in government investment projects that have been subjected to external quality assurance.</i>	Morten Welde
No 52	Statlige investeringer under lupen. Erfaring med evaluering av de 20 første KS-prosjektene.  <i>A Close-up on Public Investment Cases. Lessons from Ex-post Evaluations of 20 Major Norwegian Projects</i>	Gro Holst Volden and Knut Samset
No 53	Fremsynsmetoder  <i>Foresight methods</i>	Tore Sager
No 54	Neglected and underestimated impacts of transport investments	Petter Næss, Gro Holst Volden, James Odeck and Tim Richardson
No 55	Kostnadsstyring i entreprisekontrakter  <i>Cost performance in construction contracts</i>	Morten Welde, Roy Endre Dahl, Olav Torp and Torbjørn Aass
No 56	Erfaringer fra styring og gjennomføring av store statlige IKT-prosjekter  <i>Experiences from governance and implementation of major public ICT projects</i>	Håkon Finne
No 57	Effektivitet og produktivitet i norsk veibygging 2007-2016  <i>Efficiency and productivity in Norwegian road construction 2007-2016</i>	Kenneth Løvold Rødseth, Rasmus Bøgh Holmen, Finn R. Førsum and Sverre A.C. Kittelsen
No 58	Mandater for konseptvalgutredninger. En gjennomgang av praksis.  <i>The Terms of Reference Document for Conceptual Appraisal. A Review of Current Practice.</i>	Knut Samset and Morten Welde
No 59	Estimering av kostnader i store statlige prosjekter: Hvor gode er estimatene og usikkerhetsanalysene i KS2-rapportene?	Morten Welde, Magne Jørgensen, Per Fridtjof Larsen and Torleif Halkjelsvik

Report	Title	Author (-s)
	<i>Estimating costs in large government investment projects. How good are the estimates and uncertainty analyses in the QA2-reports?</i>	
No 60	Noen krevende tema i anvendte samfunnsøkonomiske analyser. En undersøkelse av praksis i Statens prosjektmodell  <i>Salient topics in cost-benefit analyses of major public projects in Norway</i>	Haakon Vennemo, Jens Furuholmen, Orvika Rosnes and Leonid Andreev
No 61	Samspill i bygg- og anleggsbransjen  <i>Partnering in construction projects</i>	Svein Bråthen, Maria Laingen, Paul Torgersen and Merethe Kristin Woldseth
No 62	Vegprosjekter, verdiskaping og lokale mål  <i>Road projects and local economic impacts</i>	Morten Welde, Eivind Tveter and Anne Gudrun Mork
No. 63	Betydningen av lønnsomhet ved valg av vegtrasé i kommunedelplanprosessen  <i>The importance of value for money when choosing a road route in the municipal sub-plan process</i>	Ingri Bukkestein and Ole Henning Nyhus
No. 64	Hvordan lykkes med digitalisering? En undersøkelse av nyttestyring av IT-prosjekter i offentlig sektor  <i>How to succeed with digitalization? A study of benefit management in public IT projects</i>	Helene Berg, Kjetil Holgeid, Magne Jørgensen and Gro Holst Volden
No. 65	Styring av prosjektporteføljer i offentlig sektor  <i>Management of project portfolios in the public sector</i>	Ingri Bukkestein, Gro Holst Volden and Bjørn Andersen
No. 66	Endringer i beregningsforutsetninger og betydning for samfunnsøkonomisk lønnsomhet i samferdselsprosjekter  <i>Changes in cost-benefit analysis assumptions and their impact on net benefits of transport investments</i>	Askill H. Halse, Paal B. Wangsness and Harald Minken

Report	Title	Author (-s)
No. 67	Til Dovre faller? En studie av faktisk levetid for veg og jernbane <i>The service life of transport infrastructure: An ex-post analysis of rail and roads</i>	Eivind Tveter, Tore Tomasgard and Maria Laingen
No. 68	Stanse svake prosjektforslag oftere og tidligere? Gjennomgang av internasjonal litteratur <i>Stopping weak project proposals more frequently and earlier? A review of international literature</i>	Tore Sager
No. 69	Til rett tid? En undersøkelse av forsinkelser i gjennomføringsfasen av store statlige prosjekter <i>Over time or on time? A study of delays in large government investment projects</i>	Morten Welde and Ingrid Bukkestein
No. 70	Hva kjennetegner samfunnsøkonomisk lønnsomme vegprosjekter? En analyse basert på data fra nasjonale transportplaner i Norge og Sverige. <i>What characterises road projects with a positive value for money? A study based on data from national transport plans in Norway and Sweden</i>	James Odeck, Maria Börjesson, Johanna Jussila Hammes, Gro Holst Volden and Morten Welde



# Concept report no. 70

[www.ntnu.no/concept/](http://www.ntnu.no/concept/)

Forskningsprogrammet Concept skal utvikle kunnskap som sikrer bedre ressursutnyttning og effekt av store, statlige investeringer. Programmet driver følgeforskning knyttet til de største statlige investeringsprosjektene over en rekke år. En skal trekke erfaringer fra disse som kan bedre utformingen og kvalitetssikringen av nye investeringsprosjekter før de settes i gang.

Concept er lokalisert ved Norges teknisk- naturvitenskapelige universitet i Trondheim (NTNU), ved Fakultet for ingeniørvitenskap og teknologi. Programmet samarbeider med ledende norske og internasjonale fagmiljøer og universiteter, og er finansiert av Finansdepartementet.

*The Concept research program aims to develop know-how to help make more efficient use of resources and improve the effect of major public investments. The Program is designed to follow up on the largest public projects over a period of several years, and help improve design and quality assurance of future public projects before they are formally approved.*

*The program is based at The Norwegian University of Science and Technology (NTNU), Faculty of Engineering Science and Technology. It cooperates with key Norwegian and international professional institutions and universities, and is financed by the Norwegian Ministry of Finance.*

## Address:

The Concept Research Program  
Høgskoleringen 7A  
N-7491 NTNU  
Trondheim  
NORWAY

ISSN: 0803-9763 (paper version)

ISSN: 0804-5585 (web version)

ISBN: 978-82-8433-018-1 (paper version)

ISBN: 978-82-8433-019-8 (web version)

