OSLO LUFTHAVN AS

Oslo Airport Gardermoen
Terminal 2
Impact assessment of the development

Oslo Airport Gardermoen
Consultation edition
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FOREWORD

Oslo Airport Gardermoen – OSL – has as a result of strong traffic growth in recent years, a need to expand the airport's terminal and aircraft parking capacity. In order to prepare for this, a project was initiated in 2007, the Terminal 2 project, with the purpose of studying and planning the required expansion, including the development of a new terminal and aircraft parking. As a stage in the study and planning work, an impact assessment has been carried out in accordance with the provisions of the Planning and Building Act. The study has been carried out in cooperation with Ullensaker municipality as planning authority, and in accordance with an established Study programme, approved by Ullensaker municipality on 31 March 2008.

Even though we are currently experiencing an economic slump, which has also led to a decline in air traffic, it is considered important and prudent to take a long-term view and therefore prepare for the development of a Terminal 2. The forecasts for future passenger traffic are still presumed to apply, but perhaps somewhat later than previously assumed.

The impact assessment of the individual subjects have been carried out by various specialist consultants and relevant specialist departments at OSL, who also possess much specialist knowledge and important operational experience from the more than 10 years that have passed since the airport opened.
The present impact assessment has been prepared and summarized by OSL through the Terminal 2 project.

In parallel with the studies, a planning competition for the design of a new terminal and pier has been carried out. Five consultancy groups/teams participated in this competition and the winner/proposed solution was approved by the Avinor board on 12 February 2009. The present impact assessment includes a more detailed description of the winning project.

The development of Terminal 2 includes changes and extensions within the airport area that require a new application for a licence in accordance with Forskrift om konsesjon for landingsplasser [Regulations concerning licences for landing sites]. Said application has been submitted to the Civil Aviation Authority and the present IA will also be included in a parallel process with a separate consultation round.

Upon announcement and consultation of the study programme in November 2007, initiation of planning work for changing the zoning plan as a result of Terminal 2 was also announced. There it was assumed that the continued process for the IA and changes to the zoning plan were to be coordinated. Preparation of necessary planning documents in connection with this must be based on the winning entry in the competition. This work requires somewhat more time, and will therefore be submitted to the municipality later.
Ullensaker municipality will further undertake the necessary consideration of the IA and plan change, with consultation/public review and final consideration/approval, in accordance with the provisions of the Planning and Building Act.

Questions on the impact assessment may be directed to:
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OSL – Gardermoen, 3 April 2009

Bjørn Vinge
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SUMMARY

Introduction and background

As a result of strong traffic growth in recent years, Oslo Airport Gardermoen has a need to expand the airport's terminal and aircraft parking capacity. To prepare for this, OSL initiated a separate project in 2007, the Terminal 2 Project, with the purpose of studying and planning the development of a new terminal and aircraft parking areas.

Passenger growth in recent years has been substantially higher than indicated by earlier prognoses, and the passenger total for 2008 was 19.3 million. The current terminal and aircraft parking is scaled for approx. 17 million passengers, but may by way of certain capacity-enhancing measures satisfactorily serve 22 - 23 million passengers.

Forecasts from the Ministry of Transport and Communications (Norconsult/ TØI 2007) that form the basis for assessing the need and timing for development and scale of a new Terminal 2, indicate traffic developments with 25 million passengers in 2015, 30 million in 2020 and 40 million in 2030.

Due to the decline in air traffic recently, both the progress and scope of a staged development of Terminal 2 is currently being reassessed. It will in all likelihood take somewhat longer than previously assumed to reach the passenger figures in the forecasts that formed the basis for previous assessments. OSL is nevertheless of the opinion that it is important to take a long-term view and build for the future. The decline is considered to be of a temporary nature, and in a few years times there will be a need to increase capacity both on the terminal side and of aircraft parking stands.

Study and planning process – established study programme

As a stage in the planning and study work it was, following consultation with Ullensaker municipality as the planning authority, clarified that the development of a new terminal would be such a comprehensive measure in terms of both scope and investment that there was a need to carry out an impact assessment. At the same time as it was considered important to study relevant consequences as a result of the traffic growth the forecasts indicate, and that the development is presumed to handle. This applies regardless of whether this is currently considered to occur somewhat later than first assumed.

A proposal for a study programme was, following consultation/public review, adopted by Ullensaker municipality, through a decision in the Main Committee for Overall Planning (MCOP) on 31 March 2008. The impact assessment has been carried out in accordance with the stipulated study programme. In connection with notification and distribution of the planning programme, commencement of planning work for required changes to the zoning plan as a result of Terminal 2 was also announced. Preparation of the necessary planning documents based on the winning entry from the competition will require somewhat more time, so this will be submitted to the municipality following the IA. A more detailed description of relevant planning changes is therefore not included here.

Description of the current situation, the measure – Terminal 2 and staged development

The current terminal and piers cover a ground area/footprint of approx. 42,000 m^2, and have a combined floor space of approx. 145,000 m^2. There are currently 34 aircraft parking stands with passenger bridges in addition to parking spaces by the Commuter lounge (at the end of the western pier), as well as remote parking stands for both passenger and freight aircraft. These total 56 aircraft parking stands. An expansion of the central building is also carried out toward the east, which will be brought into use in the spring/summer of 2009.

Work on identifying possible location alternatives for a new terminal and new aircraft parking stands commenced as early as the autumn of 2006. Following comprehensive assessments and evaluations of functionality, efficiency, costs, access conditions and more, it was concluded that the development of a new terminal and new aircraft parking stands would have to take place in the central area in connection with the current terminal. In March 2008 it was decided that the V6 alternative would form the basis for further studies and planning. This alternative also formed the basis for the completed planning competition.

The competition basis for the planning competition presumed that Terminal 2 was to be developed in two phases. The first phase of the development was to provide capacity for 28 million passengers. It was to commence in 2009/2010 and be completed by 2013. Terminal 2 – phase 2, was intended for a capacity of 35 million passengers. This phase was, based on available forecasts, presumed to be relevant to develop in the 2020 – 2025 period.

As previously mentioned, the financial slump has also led to a decline in air traffic in recent months. Even though traffic is expected to pick up, it will probably take somewhat longer than expected before the passenger figures indicated in the forecasts are achieved. There are thus also reasons to more closely consider both the progress and scope of the development in the various phases. This work has been initiated.

The planning competition – winning project/proposed solution
Following the completion of the planning competition and subsequent evaluation, the board meeting of Avinor on 12 February decided on a winning project/proposed solution for a new terminal. Behind the winning project, called TerminalEN, was a multi-disciplinary team comprising Narud Stokke Wiig Arkitekter og Planleggere AS, COWI AS, Norconsult AS, Ingeniør Per Rasmussen AS and Dr. Ing. A.Aas-Jakobsen AS. In connection with the Terminal 2 project, these have established a new company, TEAM_T AS, which also includes a number of sub-consultants.

The winning project proposes building Terminal 2 as an extension of the current terminal/central building westward, such that there would still be only one terminal consisting of one central building. A new pier is to be built at a right angle northwards from the current central building, with one central common pier root in relation to the existing piers to the west and east. This means that passengers will only have to negotiate one terminal building. The railway station will be used to separate the two central building sections and to ensure that the walking distance from the station to check-in is as short as possible.
The winning project also proposes a new design of the road system, including changed access to and from short-term parking and the covered parking, directly to/from the main road, via new ramps south of the main road loop and a centrally located roundabout south of the P10 covered parking. The departure and arrival plazas are extended at the same levels as today and mainly with the same widths as in front of the current terminal, and traffic flow at the top plaza is simplified and dedicated for buses and “kiss & fly”. In the current assessment of changed progress and scope of the development in the various phases, a staged development of the road system is also being considered.
The winning project has chosen to continue the existing use of materials, with steel load-bearing structures, glass façades and wooden roof structures. The same applies to indoor material use through the use of stone floors, wooden ceilings and wooden panelling. Much emphasis has been placed on energy efficiency through the choice of materials and design of the building and structures. The project also incorporates universal design well.

General plans and premises
The zoning plan including provisions from 1995 and subsequent adopted development plans for various sub-areas form the basis and set the boundaries for all developments of the airport area.
Provisions for development and operation also exist through an Environmental follow-up programme, a Design manual, an Airport plan and a Restriction plan. A Land conservation plan currently under consideration is intended to protect the tower and parts of the existing terminal.
Otherwise there are general provisions through the National Transport Plan, the county plan, various county sub-plans and the municipal plans of Ullensaker and Nannestad. National political guidelines are also mentioned.

Assessment of consequences
The impact assessment has been carried out in accordance with the assessment programme adopted by Ullensaker municipality on 31 March 2008.
Following the Storting's decision in 1990 that Gardermoen was to be planned as the new main airport for eastern Norway, a comprehensive planning and assessment process was carried out for the various transport measures; airport, road and railway, with primary focus on the consequences of the measures on the environment, natural resources and society. This planning and assessment work formed the basis for the Storting's decision in October 1992, on localization of the new main airport at Gardermoen.
Much of the assessment work from the main development is considered to have significant relevance for further development at Gardermoen. A number of analyses, assessments and studies have also subsequently been carried out of e.g. spin-off effects for trade and industry, employment and housing development.

This material has been reviewed and partly used as a basis for the assessments in connection with the impact assessment for Terminal 2.
As a basis for comparison, use of only the current buildings and other facilities (incl. ongoing extension of central building), and the limitation this will have for activities in that, with the current traffic pattern, it will only be possible to handle a maximum of 22–23 million passengers. In accordance with the traffic forecasts, capacity at OSL could thus be exceeded between 2012–2013, and following newer, ongoing assessments, probably somewhat later.
A comparison/assessment has not been carried out for every theme. Emphasis has been on evaluating consequences of increased traffic growth/activity in relation to the current status and with a description of follow-up – proposals for measures. For certain themes only the measure/activity is described.

CONSEQUENCES FOR THE ENVIRONMENT

Emissions to air

Local air quality at OSL is primarily affected by road and air traffic, but also by the heating of homes and other individual sources. The pollution regulations impose requirements toward air quality. NILU was tasked with calculating the air quality in 2001. This formed the basis for a monitoring programme, and since 2003 OSL has operated a mobile facility for continuous monitoring of air quality. These results are reported annually. Since monitoring started, the applicable limit has been exceeded only once, for particulate matter.
OSL calculates its greenhouse gas emissions annually, expressed CO_2 equivalents. The greenhouse gas accounts identify direct emissions from own activities, purchased electricity and indirect emissions (business trips, employee travel to/from work, etc.). In 2008 OSL adopted a plan of action for reduction of own emissions and compensates for emissions that cannot be reduced through measures in its own operations, by investing in UN-approved projects in India.
In 2008 OSL procured customized software for modelling emission volumes and dissemination of air pollution. Using this software, a separate study of air quality at Gardermoen in 2007 has been carried out, which further forms the basis for extrapolation and modelling of air quality for the years 2012 and 2025. The combined emission volumes are estimated to be approximately proportional to the traffic volume. The calculations for 2025 show that the limit values for NO_2 and PM_{10} may at times be exceeded at central locations at the airport. However, this result is based on an extrapolation of the current traffic pattern and runway use. Following introduction of the Civil Aviation Authority's proposal for new approach and departure regulations, traffic will be more evenly distributed and the risk of reaching excessive values will be reduced.

Follow-up – measures

Calculations carried out for the current situation show higher values for emission concentrations that what is apparent from actual measurements. However, OSL uses the most stringent calculation results as a basis for further measures and follow-up. More emission-reducing measures are planned and have been implemented, such as a reduction in the use of fossil fuels (aircraft taxi using one engine, transition to biofuels and electrification of ground vehicles). OSL has also adopted a plan for the reduction of greenhouse gas emissions at the airport, which will also reduce other emissions. OSL has also decided to extend the air quality monitoring programme based on the calculation results, and will follow developments closely.

Consequences for water and ground, waterways and pothole lakes

Oslo Airport is located above parts of a major groundwater reservoir. Oslo Airport holds a discharge permit from the Climate and Pollution Agency and a licence from the Norwegian Water Resources and Energy Directorate (NVE) with terms that regulate the operation of the airport such that the water resources are not affected. Technical installations such as de-icing platforms, water and drainage systems and tank facilities are designed and operated in order to comply with the terms. OSL annually reports operation data and results from the Control and Monitoring Programme.
The current systems are designed so that the bulk of collected surface water is returned to the groundwater reservoir. Surface water from the western side of the airport is led to the Sogna river via three culverts along with groundwater pumped from the railway line and the western runway.

Polluted surface water from the de-icing platforms and the central area (the large aircraft parking area around the terminal) is collected during the winter and treated at the Gardermoen treatment plant, while some used glycol is transported from the area and used as a source of carbon in the nitrogen treatment process at municipal sewerage treatment plants.
Surface water that may potentially contain oil (from areas where aircraft fuelling takes place) is treated in oil separators and dedicated soil treatment plants for hydrocarbons. In addition, dedicated solutions have been established for these areas, where emergency routines are in place in case of spills and accidents, including separate emergency pipes and collection pools.

New facilities that affect water management will be established in connection with Terminal 2. This primarily applies to new aircraft parking areas and taxiway systems, in addition to new roof surfaces. In addition there will be a general increase in the number of passengers, aircraft movements and activity at the airport, which is significant for overall water management at the airport. OSL has prepared a general plan for water management where the primary focus has been to obtain an overview of the main characteristics of future surface water solutions including Terminal 2, with particular focus on polluted surface water, i.e. water from de-icing platforms containing glycol, water from aircraft parking areas and taxiways containing formate and surface water from areas where oil and fuel spills may occur.

Follow-up – measures

Clean surface water from areas where chemicals are not in use must infiltrate the ground and be led to the groundwater to ensure compliance with NVE's terms related to groundwater balance. NVE has imposed demands that the groundwater level and flow of groundwater outside of the airport area must not be affected by airport operations. This is ensured through the choice and planning of technical solutions.

All new areas with a potential risk of generating surface water containing oil must be treated in oil separators with emergency capacities followed by treatment in soil treatment plants/sand filters and infiltration to ground/groundwater or discharge to waterways.

Terminal 2 will in itself not generate increased glycol consumption as there will not be changes to the existing de-icing platforms. The general increase in aircraft movements will however entail an increase in glycol consumption. De-icing chemicals are for the most part collected at and around the de-icing platforms. This will be solved through increased pump capacities and storage volumes. The remainder is spread along the runways or transported by the aircraft away from the Gardermoen area. Surface water containing glycol that is spread along the runway systems is treated in the unsaturated zone.

Surface water from aircraft parking areas and taxiways around the terminal building contains formate during the winter. This water is collected and currently led to large retention basins before being led to the municipal network and treated at the Gardermoen treatment plant. The same principle is intended for Terminal 2. In connection with this, more retention basins must be built.

As OSL's water management affects the capacity and use of the Gardermoen treatment plant, OSL's general plan work included an assessment of the treatment capacity at the municipal treatment plant. The conclusion of this work is that the plant's capacity is sufficient to treat the agreed glycol volumes and that these will not be exceeded as a result of the T2 development. The increase of surface water containing formate will require an increase in treatment capacity toward 2018--2020. Development of the Gardermoen treatment plant will solve this issue.

Effect on waterways

OSL currently holds a permit to discharge diluted surface water containing chemicals to the Leira river. For Sogna the permit is based on “zero effect” on the waterway. OSL has hired Aquateam AS for “Impact assessment of the condition of the Sogna and Leira rivers as a result of Terminal 2 at Oslo Airport”.
The assessments comprise consequences of increased use of chemicals and increased activity related to passenger flows and airport-related activities within the airport's regulatory area. On the part of the Leira

river the consequences of increased flow of discharge water from the airport area and increased influence from surface water containing chemicals to the Sogna river is assessed.
Calculations show that the Gardermoen treatment plant's contribution to phosphate concentrations in the Leira river will not increase as a result of the Terminal 2 project. The contribution from the treatment plant to the waterway in low flow conditions comprises up to 40% of total transport in relation to the waterway's target. Possible measures for a reduction from the treatment plant may be relevant, but will be independent of the Terminal 2 project.

Erosion processes and pothole lakes
Before development of Oslo Airport in 1998 it was presumed that the ravine areas related to the Sogna and Vikka rivers were not to be affected. In order to document compliance with this, a report was prepared describing and modelling the erosion processes in the ravine area. It was concluded that changes in groundwater flux as a result of airport operations were within normal variations and that the ravine slopes are more stable at lower groundwater levels.
In connection with the T2 development it will be necessary to document that the solutions chosen for artificial infiltration ensure continued maintenance of the natural groundwater balance. If changes to the groundwater flux were to occur, it will be necessary to reassess how and to which degree this will affect the ravine processes. This should also be related to expected climate changes that entail increased precipitation volumes in shorter, more extreme sequences, which may also be significant for natural erosion.
The pothole lakes that lie east and north-east of the airport are downstream from the eastern parts of the airport. Some of lakes are in direct contact with the groundwater, others are not. In the detailed planning of Terminal 2, hereunder localization of infiltration plants, etc., it must be ensured that the groundwater level and flux does not lead to changes in the groundwater quality and the natural water balance of the pothole lakes.

Cultural environment – architecture and design
Even though the airport houses vastly differing functions with different requirements toward buildings and facilities, the airport currently emerges as a uniform facility, where aesthetic quality has been guiding for design. The design manual articulates basic perspectives and provides guidelines for all development at the airport, including the Terminal 2 project and the completed planning competition. The winning project/proposed solution is considered to sustain the architecture and design well and in compliance with preconditions.

CONSEQUENCES FOR NATURAL RESOURCES

Energy solutions
OSL's overarching goal is to choose flexible energy solutions that enable the use of alternative energy sources. Such flexibility in energy supply allows one to choose the most environmentally friendly heating method at any given time. To a large degree existing buildings comply with
this requirement and it is presumed that this principle will be pursued in the development of Terminal 2. New
requirements in the revised TEK and NS 3031 standards will be followed, and emphasis will be placed on describing solutions that ensure the choice of products with low energy requirements.

Follow-up – measures
The project's goal is to achieve significantly lower energy consumption per square metre than the current terminal. It is presumed that the new buildings will be planned and built such that a significant proportion of the heating requirement can be covered by other energy supply forms than electricity and/or fossil fuels.
This early in the project phase the final solutions are still not clear, but the winning project focuses on the subject and has described issues and proposals for solutions that will be evaluated in more detail in the draft and preliminary phases.

Earth moving – raw materials for building
For the initial development of the main airport a separate material disposal plan was developed that included all major material moving and disposal work. This material disposal plan described the terms for

removal and disposal, the type of materials, the individual removal locations and the system for follow-up and continued updating of the plan.

During the course of 2009 a new updated overview of all material deposits and material removal within OSL's area, with indications of volumes and descriptions of content. Steering documents will also be prepared that provide an overview of the permits that various activities require and how these are prepared and complied with. These steering documents will provide clear guidelines for how development projects and day-to-day operations at OSL relate to material disposal and material removal inside the airport area.

Follow-up – measures
In accordance with the aforementioned, a separate material disposal plan will be drawn up for the Terminal 2 project. This may only take place when the planning process reaches a more detailed stage and the necessary basis for calculating material removal and various material requirements are available.

CONSEQUENCES FOR SOCIETY

Aircraft noise

Noise zone charting currently exists with an official noise zone chart for the period 2002–2020, drawn up in accordance with the Ministry of the Environment's guideline T-1277 – Area use in aircraft noise zones. This forecast for traffic in 2020 employs a high forecast with 322,300 aircraft movements.
In 2005 the Ministry of the Environment introduced a new guideline, T-1442: Guideline for managing noise in area planning. This guideline also includes guidelines for calculating aircraft noise.
Charting an aircraft noise zone pursuant to T-1442 must include a prognosis of the situation in 10–20 years time, as is also the case under T-1277. In order to be able to prepare this kind of forecast, it is essential that we know the content of the forthcoming regulations for approaches and takeoffs at Oslo Airport Gardermoen. The Civil Aviation Authority's proposal for new regulations for approaches and takeoffs is currently being processed by the Ministry of Transport and Communications. Several aspects of this proposal will change the noise situation around the airport. In connection with the Civil Aviation Authority's (LT) preparation of a proposal for new regulations, a noise impact assessment of the changes proposed in the new regulations was created, and OSL prepared noise zone charts pursuant to T-1277 for the years 2002 and 2020.
OSL does not consider it worthwhile preparing new aircraft noise charts pursuant to the new guidelines from the Ministry of the Environment, before a decision has been made regarding how air traffic is to be regulated in the future. However, in connection with this impact assessment for Terminal 2, new noise calculations have been performed pursuant to the Ministry of the Environment's new T-1442 guidelines, but these have been based on the Ministry of Transport and Communication's current noise regulations for OSL (AIP ENGM AD 2.21).

Follow-up – measures
OSL continuously monitors noise conditions around the airport using an advanced Noise and Route Monitoring facility. This forms the basis for monthly reporting to the Civil Aviation Authority, Ministry of Transport and Communication and the neighbouring municipalities.
OSL does currently not have further information on future air traffic. Terminal 2 will in itself not alter preconditions for traffic volumes and traffic distribution, and OSL does therefore not see the need to initiate a new round of noise charting in order to update the official noise zone chart before new regulations for approaches and takeoffs are available.
The development of Terminal 2, including the location of the new terminal and pier in connection with the existing terminal building, is not considered to have consequences for the approach and takeoff pattern, runway use or use of the de-icing platforms. This also applies if the taxiing pattern is changed, in that the current taxiway is moved northwards due to the new pier. Further evaluations of the future noise situation must be awaited until new regulations for approaches and takeoff are available.

Feeder traffic – transport network

The assessment of this subject initially deals with the entire transport system for feeder traffic to/from OSL, but will discuss the Oslo axis somewhat briefly as this is dealt with in particular in TØI's study/report "OSL Terminal 2 – Parking and public transport share". Particular emphasis has been placed on

discussion and assessments of requirements and capacity in terms of public transport as well as the road aspect. Further, focus is on development scenarios for the east-west axis, with primary focus on the Jessheim-Gardermoen area.

The pedestrian and bicycle path system to the airport has not been given special consideration. It is nevertheless considered important that this system as well, particularly toward Jessheim and Nannestad, is developed and operated in order to provide safe access for everyone who would prefer to use such a facility.
With respect to the total volume of feeder traffic to/from the airport, the scope of pedestrian and bicycle traffic will however be of less significance.

The time perspective of the assessments have been defined with reference to the two development phases for Terminal 2, as they were originally indicated in the study programme; phase 1 with completion in 2012 and phase 2 with completed development in 2025. Traffic has increased significantly faster than the original forecasts indicated, such that capacity for the completed development could be reached significantly earlier, perhaps as soon as 2020. Based on this, the study has used the years 2012 and 2025 as relevant key years for preparing statistics, in addition to a trend projection to the year 2040.
The total number of passengers to/from OSL includes transfer passengers who only use the airport/terminal between two trips, and passengers who start or terminate their trips at OSL. The study primarily deals with this last group of passengers, in addition to all employees and visitors who also use the land transport service to/from the airport. The estimates for future traffic load for car and public transport to/from the airport are based on forecasts for the development in the number of air passengers and the number of employees connected to handling the air traffic. Further, it deals with developments in traffic distributions up to the present as well as assessments of capacity and travel times for car and bus, as well as rail-based means of public transport toward the forecast dates. The use of eventual restrictive measures to influence traffic distribution, e.g. parking restrictions, have not been specifically considered.

A target of a public transport share of 65%, which is indicated as a possible target in certain governing documents, has not been used as a guideline in the report's scenario descriptions, but the report's assessments indicate that such a target may as well be probable, based on what currently exists in terms of plans for developing the transport service.
In the discussion of the future transport service for cars and public transport, including parking, the assessment pursues the municipality's clarification that this must be viewed in a long term perspective and the desire for an overarching, combined overview of the parking facilities. The assessment further complies with the municipality's decision, where it emerges that the possibility for better local feeder transport between Jessheim and the airport must be studied, where a rail solution may be relevant.
Finally, the study deals with the municipality's request that for the construction period there should be a careful assessment of works traffic and environmental effects, and a description of measures on the main and local road network.

Current traffic and transport system

Out of the total number of air passengers, 19.3 million in 2008, it is estimated that approx. 14.2 million passengers, or roughly 39,000 on average per day, use the road and public transport system to and from the airport. In addition there are the employees, visitors, goods deliveries and freight transport to the airport, etc.
TØI's report reveals that a huge 87% of passengers come from the south, primarily from the Oslo area. The combined total for passengers from all directions is a public transport share of just below 60%, where of 41% use the train and 18% use the bus. Out of the combined car traffic to/from OSL, figures from 2007 show that 60% is generated by air passengers while 32% is employee traffic and 8% is visiting traffic.

The public transport service is significantly better toward the south than toward other directions from the airport due to the Airport Express Train and NSB's comprehensive and frequent departures. The service is poorest toward west and east, where bus traffic has difficulties competing with car traffic. The public transport service in “Jessheim city” is primarily based on local use of regional bus routes. Even though the scheduled service may not be perceived as poor, the route network and frequency is not good enough to attract larger shares of local passengers to the airport. The capacity of the road network in the airport's vicinity has increased somewhat since the opening in 1998, particularly along the east-west axis. Up until now there has been adequate reserve capacity in the “old” road network.

Background for future traffic developments

Forecasts for developments in the number of air passengers to/from OSL from 2007 (TØI 2008) indicate an annual growth of between 2.2 % (LOW) and 3.3 % (HIGH) per year. Disregarding transfer passengers this entails that the number of air passengers using the feeder system to/from OSL will increase from 14.2 million passengers in 2007 to between 20 and 25 million in 2025 and then to between 29 and 42 million in 2040 for the LOW and HIGH forecasts respectively. In other words, we can expect an increase of between 40 and 80% up to 2025, and an increase of between 100 and 200% up to 2040.
The employees comprise the second largest group of travellers to/from the airport. In 2007 there were approx. 13,000 employees connected to traffic and operations at OSL. With reference to various documents on developments, it is estimated that the number of employees at OSL may increase from approx. 13,000 in 2007 to between 17,700–21,700 in 2025 and further to between 23,500–33,700 in 2040 for the LOW and HIGH forecasts respectively.

Settlement patterns for employees have changed significantly since the airport opened in 1998. It is expected that these changes will continue in the time ahead so that the municipalities in Øvre Romerike will increase their share of employees from 32% in 2007 to 42% in 2040. The municipalities in Nedre Romerike will also increase their share, while the share living in Oslo and Asker/Bærum will be reduced. Among other things, this means that the number of employees living in Ullensaker may increase from approx. 2,000 in 2007 to between 4,700 and 6,700 in 2040.
A number of overarching public reports discuss developments at Gardermoen, and have also provided/proposed a number of guidelines and recommendations for how developments should be governed and facilitated. The documents all identify somewhat very specific measures for adaptation of the public transport system in particular, with a view to improve its attraction and achieve higher traffic shares.

Road traffic and road network

Road traffic will increase significantly in the years ahead if the forecasts for increased air traffic are correct. Different figures are presented based on different analyses. Currently it is difficult to be sure of which figures will apply, but alternatively the differences may rather be understood as merely a question of when the forecast traffic figures will occur. The absolute requirement toward road capacity and number of lanes thus varies little in a long-term perspective.
Passengers arriving in their own cars or who are dropped off constitute 45% of car traffic to the airport. The current road traffic distribution to the airport area shows that a huge 80% of road traffic is generated south of the airport, 8% to/from the north, 9% to/from the east and only 3% to/from the west. Local traffic in Ullensaker to/from the airport currently constitutes approx. 7.5%, whereof most is included in the traffic figures from the east.

Road traffic forecasts in the case of HIGH growth in air passenger figures at OSL Gardermoen 2007 – 2040

Traffic to/from OSL constitutes a large share of traffic on the road network in close proximity to the airport, but drops fast as the distance from the airport increases. While the share constitutes around 90% on national road 35 just east of the terminal, the share drops to around 50% on the E6 just south of Jessheim. On the E6 northwards the share is only approx. 10 %.
The share on the E6 towards Oslo drops further the closer one gets to Oslo. According to TØI's report, the share in the afternoon rush hour is currently only approx. 13% at Skedsmovollen and approx. 7% at Furuseth. Forecasts indicate that the share may double in 2040, but it will remain modest compared to other traffic.
Capacity problems on those parts of the road network with traffic to/from OSL will primarily be on the E6 southwards from the national road 35 intersection. The current planning programme for development of the primary road network (National Transport Plan) indicates few new measures toward 2019, beyond the work that is currently under way in building four lanes northwards from Jessheim and four lanes from Kløfta towards Kongsvinger. This entails that road capacity will be adequate towards the west (national road 35), towards the north (E6) and towards the east (national road 174+ national road 2) for regional transport for many years to come. Towards the south an undeveloped road network will not be capable of handling the traffic volumes on the E6 that are estimated in 2030 and 2040. The need for an expansion

from four to six lanes may become somewhat urgent from 2020 and on. This may entail an increase in travel time by car from Oslo of around 10 minutes until 2025 (TØI 2007).

The road network in the Jessheim area may in the longer term experience significant traffic problems if measures are not implemented to increase capacity. The need is not specifically the increase in car traffic between the airport and Jessheim, but growth in housing developments and associated services, as well as the strong growth in jobs that is expected in Gardermoen Industrial Estate. This will partly be the result of the normal growth of the urban area, partly as spin-off effects of the growth at the airport.
The development of the road network in the Jessheim area is primarily the responsibility of the municipality and the Norwegian Public Roads Administration, but it is important that this is also functionally designed in relation to the airport.

Public transport – public transport share and parking facilities
Oslo Airport Gardermoen has the highest share of public transport of all European airports and is number five in the world, according to a British survey from 2007. At the time of the survey, the public transport share at OSL was 60.1%, while the average for all of the 57 airports in the survey was only 25.5%.
Almost all governing documents concerning future transport strategies recommend that in the future one must focus efforts on increased use of public transport and increased public transport shares, not only for passengers to/from OSL, but for society as a whole.
With respect to the high share of public transport already enjoyed by OSL, it is natural to imagine that it would be difficult to achieve further increases, however, conditions appear to be very favourable for this to happen without other measures than those already planned. This particularly applies to the axis towards Oslo where significant standard and capacity improvements of the train service in particular are planned. The effects are strengthened by the fact that road travel times must be expected to rise and reduced competitive ability in that no increase of the road capacity is planned to keep up with traffic growth, at least not for the next 15–20 years.
For the other directions, toward the west, north, east and the local Gardermoen – Jessheim area, it is far more difficult to predict opportunities for increased public transport shares. The public transport service has limited competitive ability compared to car traffic, and efforts must be very focused to significantly increase public transport shares. It will be very important that all bodies/organizations that can influence transport view this as their joint responsibility and establish a common, agreed strategy for future public transport.
In total, assessments in the study indicate that the public transport share for both air passengers, employees and visitors may be expected to increase in the years ahead based on expected developments in public transport and in the road system.

A number of measures are planned for rail, both in terms of the rail network and train services. This is expected to significantly increase capacity, quality and attraction. Much may already be in place from 2012. The Airport Express Train and local trains on the Oslo – Gardermoen/Jessheim line will provide more than double the current capacity, if plans are carried out as presumed. Services toward the north will also improve, albeit more modestly. The bus companies are also planning improved regional services, but it is difficult to achieve competitive advantages as long as the buses have to compete with cars on well-developed high-capacity roads to the north, west and east.

The preconditions for increased public transport shares will ordinarily and primarily depend on improved travel time relationships between public transport and cars. For public transport this primarily entails shorter travel time, higher frequency and better regularity, but comfort and price are also significant. On the part of roads, reduced travel speed/increased travel time will have the same effect.

The use of parking restrictions at Gardermoen may also increase the public transport share, but such measures may be unreasonable for passengers who lack access to appropriate public transport services.
A review of the transport service plans indicate that the possibility of increased public transport shares exist, particularly for rail transport toward Nedre Romerike and Oslo with connections on to Østfold and Vestfold/Buskerud. NSB's and the Airport Express Train's plans for increased frequencies and capacity provide, along with increased travel time for cars, an obvious basis for increased public transport shares in this corridor.

The bus companies are indicating increased regional services to the west, north and east, but as already mentioned, it is difficult to predict changes to public transport shares.

In the current municipal planning for Ullensaker, it is proposed to facilitate development of public transport in the Jessheim – Gardermoen area in particular. A better bus service with express buses would be a natural core of the system, but the possibility of establishing rail solutions in the longer term are also being considered.
A circle line solution that connects the main railway (between Oslo and Eidsvoll) and the centre of Jessheim with Gardermoen Industrial Estate and the airport is a possibility, and a route for this is also indicated in the municipal plan's land use section. Such a rail solution could provide a somewhat higher public transport share from Jessheim to the airport, but it is difficult to justify the solution based only on this traffic. The rail solution will first and foremost provide better opportunities for increased public transport from Oslo and Nedre Romerike to Gardermoen Industrial Estate. This may have great significance for traffic to/from the industrial estate, which in time may have almost as many jobs as the airport. A purely local rail solution between Jessheim and Gardermoen with frequent stops has also been considered, but does not appear to provide the same opportunities.

Future traffic distribution between public transport and other modes of transport for air passengers has been stipulated. The distribution is based on a trend projection of TØI's forecasts supplemented with further assessments of the competition relation between car and public transport. The public transport share may thus be expected to gradually increase from 59% in 2007 to 68% in 2040. A public transport share of 65% may be achieved around 2030.
Developments in public transport shares for air passengers toward Oslo and Øvre Romerike have also been stipulated. This shows that the public transport share from the Oslo area is very high already, and that it may reach 70% around 2025. Øvre Romerike is significantly lower than the average. Passengers in this area must be offered significant improvements in public transport where the frequency and travel time must be perceived as a good alternative to the car if one is to hope for a significantly improved share on public transport.

Employee public transport share
For airport employees too the share of those using public transport is expected to increase in the years ahead, even though the point of departure is significantly lower than that of passengers (approx. 28%). The share is stipulated to increase from approx. 28% in 2007 to approx. 37% in 2040. The low share is of course related to the fact that a very high proportion of airport employees work shifts that are incompatible with the public transport services, while at the same time more and more employees are taking up residence in Øvre Romerike where the service is poorer than where they previously lived.

Parking capacity and service
The parking capacity at the airport area has been gradually increased in line with demand. Both passengers, employees and visitors currently have good and adequate parking facilities. This applies both to the facilities on OSL's area and the surrounding private parking facilities. Facilitation of good parking services is decisive in order to satisfy requirements and aspirations toward good accessibility. At the same time income from this parking is an important source of income for OSL and other parties. With continued growth in air traffic, demand will increase significantly.

The combined parking capacity for OSL and other parties currently constitutes approx. 28,800 parking spaces. Of these, approx. 22,750 or just less than 80% are intended for air passengers. No distinction is made between short-term and long-term parking here. Private parties outside OSL's area have in recent years significantly expanded their parking services and currently provide approx. 8,000 spaces. Inside OSL's area there are approx. 15,500 spaces for passengers, whereof approx. 8,500 are covered.

Alternative forecast figures for growth in parking requirements have been drawn up, depending on whether the point of departure is the growth in the number of air passengers, the growth in annual average daily traffic as stipulated in the study, or whether one also includes a change in traffic patterns where more are dropped off at the airport rather than driving themselves and parking. The models also provide somewhat differing figures for parking space requirements in the longer term. Which forecast figures to use is a matter of debate, but they can also be perceived as merely an expression that given

needs arise at somewhat differing times. This indicates an increase in parking requirements in the range of 50% up to 2025 and a doubling up to 2040.
The assessments also indicate that without an increase in capacity in the years ahead, exploitation of the service will become so high that the parking situation at Gardermoen will be perceived as difficult in 2015.

Park and ride – transfer to train and express buses
OSL is a traffic hub with very good public transport services for passengers. As a stage in a general strategy to increase the share of public transport in the region, there has for a long time been a desire to establish a major parking facility at Gardermoen for park-and-ride for local travellers to Nedre Romerike and Oslo. In functional terms this could be ideal for road users, but it is considered incompatible with both the pricing of the parking service and the scarce land resources close to the terminal points at the airport area. Such park-and-ride parking is important to achieve higher public transport shares to/from the areas around the airport, but the service would probably have to be established at other locations with good public transport services. For access to trains this could mean park-and-ride and a new train station for local trains on either the Gardermoen line north of the airport or on the main line at e.g. Dal station.

Parking service versus public transport shares for traffic to/from the airport
Limitations on the number of parking spaces combined with restrictive regulation of parking services, e.g. in the form of increased parking fees, are often mentioned as possible instruments to stimulate increased use of public transport. For employee parking car use may also be influenced if one were to change tax regulations related to free or subsidized employee parking. However, experience shows that the effect of such limitations is usually moderate and that strong measures are required to achieve radical change.
In general, the use of such instruments will reduce access to the airport unless one also compensates through significant improvements to public transport. This may be possible for some travel relations where the traffic basis is large, e.g. towards Oslo, but not for the majority of travel relations where both the traffic basis is too small and where quality and competitive ability for public transport cannot be adequately developed. For some travel relations the service is so poor that passengers in reality have no options in terms of mode of transport. Parking restrictions cannot be used without reducing accessibility for a significant number of travellers to the airport.
Instead of measures directed at parking at Gardermoen, the use of road pricing/toll roads for traffic towards Oslo may be a more targeted and better instrument. However, here too one will reduce accessibility for road users using the E6 and who cannot use the good public transport service to Oslo.

Parking service – future regulations
The parking service outside of the airport area consists of parking companies that provide the lease of parking spaces to passengers, and parking spaces in connection with various airport-related undertakings such as e.g. hotels, conference centres and bedsit rentals, catering, etc.
The private parking companies have grown considerably in recent years, and continued initiatives for expansion must be expected in time with future growth in air traffic.
If it should become a goal to use parking facilities and parking regulations as an active instrument to influence e.g. the distribution between cars and public transport, it would be very important that authorities allow for comprehensive evaluations and management of the entire parking service, both within and outside of the airport area.

Spin-off effects – trade and industry, employment and settlement
When the Storting decided in June 1990 to plan Gardermoen as a new main airport, localization was also intended as an instrument to strengthen development north of Oslo and the eastern Norway region in general. The Storting therefore requested that a planning project was carried out in cooperation with the county municipalities and affected municipalities, with the aim of facilitating regional development. This project was carried out in parallel with the other planning work for Gardermoen (airport and feeder system) and was a part of the collective planning and evaluation work. The regional planning project focused on Oslo and Akershus counties, but also included assessments of the airport's importance for Hedmark and Oppland. It incorporated a description of the indirect/regional effects of the Gardermoen project (airport and feeder system) and a move of parts of the Norwegian Armed Forces' operations in the Gardermoen area (The Norwegian Armed Forces' planning project).

The project is summarized in “Main report – Regional effects of the main airport at Gardermoen” of December 1991. Results/conclusions from this work are not referred to, but are summarized through that the development of Gardermoen as the main airport would be one of many factors that would affect regional developments in eastern Norway. Based on the forecasts for air traffic growth and number of airport employees that were available at the time, the development of the airport and feeder system would be a key factor for the development of eastern Norway for the next 30 years.

Completed analyses and studies

Subsequently several studies and analyses of the spin-off effects have been carried out both before and after the opening of the new main airport. In 1996–97 the first study was carried out that reviewed the effects of Gardermoen and Fornebu as of 1995 This was followed up in 2001/2002 by a new study, after Gardermoen as main airport had been in operation for three years. The third and latest study documents the situation as of 2005 and some development trends in the period between 1995–2005. The studies have been primarily carried out by the Institute of Transport Economics (TØI). As a stage in developing the county sub-plan Gardermoen 2040 – Strategic development plan for Gardermoen, in 2005 TØI summarized the previous reports and included some perspectives on the future. The main content of this chapter is reproduced from the documents mentioned.

A rough distinction is made between direct and indirect (consequential) effects. The spin-off effects are both real and quantifiable and they are significant. A development has been recorded where many effects are already present in the area around the airport, but the potential for the local area's share of the total effects has not yet been reached.

At the time of the latest TØI study in 2005, there were 12,300 employees at the airport, which represented approx. 10,500 man-years. These included 8,000 airline employees and employees of related services such as handling and maintenance. 800 were employed by OSL and with public authorities (customs, police, post, ambulance), while hotels, restaurants and retail employed 1,350. The armed forces had 250 employees, while 1,800 were employed in other services such as transport, security, cleaning, parking, etc.

TØI's point of departure is that there is a positive correlation between passenger growth and direct airport employment and presumes that employment will grow in time with traffic development. The number of passengers in 2005 was approx. 15 million. This provides a key figure of approx. 800 employees per one million passengers, which is slightly below but almost at the same level as the average for European airports.

The number of employees has grown in time with traffic growth at the airport, and was close to 15,000 in 2008. It is assumed that the distribution between the different sectors is the same as in 2005. TØI refers to an increase from 12,000 employees in 2005 to 21,000 employees in 2020, based on 26 million passengers in 2020. According to the forecasts that indicate 30 million passengers in 2020, this will correspond to approx. 24,000 employees, i.e. 9,000 more employees at Gardermoen toward 2020.

In terms of calculating the indirect effects in relation to employment, a multiplier is used that indicates that for each employee directly employed in an airport function, 2.5 indirect jobs are created. Based on this, Gardermoen/Fornebu created approx. 35,000 jobs. Based on the fact that the same number of direct employees were found in both 2001 and 2005, for these years Gardermoen represents approx. 43,000 indirect jobs. If the same multiplier is applied to the assumed direct employment of 21,000 in 2020, this corresponds to total employment of 73–74,000 persons in 2020.

Innovasjon Gardermoen (IG) is a network and interest organization for businesses in eastern Norway. IG has in recent years had more than 200 members, and these member businesses represent indirect effects. They have therefore been used in TØI's studies to survey indirect effects and which geographic structure that shows where subcontractors to undertakings that are directly related to operation of the airport are located.
As early as three years following the opening, a pattern was established that continues to the present. Two areas have a strong dominance; one is the local area in Ullensaker, i.e. Gardermoen – Jessheim. The second and most important is Oslo, which has approximately the same supply share to Gardermoen today as it had to Fornebu ten years ago. Ullensaker and Oslo have a total of approx. 75% of supplies to the airport. There also appears to be a tendency to concentration in the corridor towards Oslo, Øvre Romerike beyond Ullensaker, while the local areas north and east are only sporadically represented in this connection.

Strong local and regional growth
The air passengers' consumption in the visited region has increased significantly and faster than air traffic. However, most consumption occurs in Oslo. The population development and population forecasts draw a clear picture, characterized by very strong local and some regional growth, both compared to the previous situation and to other areas. Local and central forecasts indicate that these developments will continue.

Settlement
It has been difficult to relate effects to geography through the studies carried out by TØI due to resource reasons and for other reasons. The most reliable distribution is available for the direct effects, where the settlement pattern is quite accurately surveyed. As early as three years following the opening, Øvre Romerike and particularly Ullensaker were the centres of gravity for settlement for employees at Gardermoen. These developments have continued, with an increased share in Ullensaker and corresponding reductions in Asker and Bærum in particular.
In 2005 there were two approximately equal centres of gravity in settlement terms: Romerike and Oslo/Asker/Bærum, each with a 35–40% share of employees. However, developments in recent years have been such that Romerike's share is the largest, as opposed to previously. In Øvre Romerike Ullensaker stands out with as large a share as the rest of Øvre Romerike combined. A smaller share lives in Hedmark/Oppland, other places in Norway and abroad.

Population developments
In its studies and analyses TØI has looked into the relation over time between developments in population figures and the establishment of the main airport, and have also discussed commuting and studies of regional strength and competitive ability. All indicators point in the same direction; that much has happened locally and regionally as a consequence of the airport development and that indications of a cause and effect relationship are extremely clear.
TØI has compared changes in population figures over time for various municipalities and regions in Akershus, and refer to Statistics Norway's population projection, which illustrates a relatively long time perspective.
1995, 2000 and 2005 correspond to five-year periods that are relevant to compare with each other. 1995 represents the “before-state” in that the airport opened in 1998, 2000 represents an approximate starting point and 2005 the present situation.
During the “before-state” from 1995-2000 all of the regions in Akershus experienced approximately the same growth rate. Ullensaker municipality's population numbers grew in line with the county average. In the “present situation” 2000-2005 the picture changed. Øvre Romerike was then the only region with a higher growth rate than during the previous five-year period. Ullensaker stands out with a growth rate almost three times as high as the previous period, and twice as high as the Akershus municipality with the

second-highest growth rate, Nannestad. At the same time a certain tendency for growth above the average is seen in some municipalities in Nedre Romerike – Aurskog-Høland, Sørum and Skedsmo. In total this provides indications of very significant population-related effects on the airport's local surroundings, i.e. Ullensaker municipality, but also beyond this area, particularly in the corridor towards Oslo. Trends in the long-term perspective towards 2020-2025 also indicate that Øvre Romerike will grow faster than the rest of the county.

Commuting and other spin-off effects

In the 1990s, before the main airport at Gardermoen was opened, Ullensaker was a commuter municipality. More than half of the workers living in the municipality worked in a different municipality. The main airport has led to a distinct change in the trend, to a large net influx of commuters. Transport is not enough to achieve increased regional growth. If Gardermoen is to contribute to regional development in the capital area and the interior, there must also be focus on building expertise. The interior is best in the country in terms of adventure travel, and Oslo and Romerike lead the way in the course and conference market.

Socio-economic analysis – benefit to society

In a separate project called "The social benefit of aviation," initiated by Avinor with the participation of other aviation players (NHO, SAS, Norwegian and Widerøe), the aviation sector in Norway has focused on challenges and the measures that can contribute to sustainable and socially beneficial aviation. The major environmental organizations have also participated in the work.

The report emphasizes that the main task of Norwegian aviation is to contribute beneficially to social development in Norway by providing safe, efficient and eco-adapted air transportation within all regions of the country and to make arrangements that enable the nation to participate actively in global economic and social development. The National Transport Plan (2010-2019) stipulates the following targets for the transport sector: "To offer an efficient, accessible, safe and eco-friendly transportation system that covers society's need for transportation and promotes regional development".

Airport coverage is very good in Norway, and aviation contributes to linking the country together. The administration of the country's resources and the political goals for settlement in the regions have guided the building and maintenance of the airport network. It has been shown that two out of three residents have access to an airport within a journey time of one hour. The cover is particularly good in western and northern Norway. The significance of this can also be illustrated by the fact that 99.5% of the population are able to travel to Oslo and get back home again on the same day.

The industry helps provide 60,000-65,000 jobs, which is of particular importance in the regions. Overall, aviation has an impact equivalent to 4% of the country's GDP.

In an assessment of aviation as a means of transport, consideration must be given to the alternative means of travel that exist. In general, it might be said that for relatively short flights, there may be satisfactory alternatives, whereas for long journeys there are no real alternatives.

An independent report prepared in connection with this documents aviation's social and economic importance for the development of the country, hereunder regional development, globalization and social welfare. It concludes that there would be significant negative effects if possible measures to reduce or stop growth in aviation were implemented. One of the important discoveries in the report is that only a small share of passengers have alternative modes of transport than air. The alternative would be to not travel.

Socio-economic analysis of the chosen concept for Terminal 2

As a basis to assess the choice of concept and as a step in an application for an amended licence as a result of Terminal 2, a separate socio-economic analysis of Terminal 2 has been carried out. The report provides an assessment of socio-economic factors related to expanding the airport to serve the expected growth in traffic. The basis for T2 is expected growth in traffic in the period until 2035. The main elements of the socio-economic analysis part of T2 are related to the additional socio-economic costs that will arise if some of the traffic has to find other routes if OSL has capacity problems.

Based on the analyses that have been carried out, it is concluded that Terminal 2, and the chosen concept, appear to provide good socio-economic profitability. This applies even though not all economic effects are fully quantified. Even in the case of a relatively simple procedure for performing the analysis, it is concluded that the profitability of the measure is robust, particularly when the costs for the expansion of capacity at alternative airports are considered, if the terminal capacity at OSL is not expanded. This will contribute to increasing the socio-economic benefit of Terminal 2 further.

CONSEQUENCES OF THE BUILDING AND CONSTRUCTION ACTIVITIES

Currently only a preliminary draft project for the Terminal 2 measure is available in the form of the winning project. This does not provide sufficient basis to assess details concerning the scope of building activities, the number of people and how much traffic the development will generate. The assessments here are therefore based on experience and preliminary considerations and assumptions. Two building sites are planned, one north of the taxiway and new pier development, and one south of the new central building development.

Consequences for traffic

A comparison with the development in the 1995-98 period indicates that up to 1500-2000 persons may work at the site for longer or shorter periods. 1000-1300 persons may be assumed to work on the expansion of the actual terminal facility, while 500-700 persons will belong to the building site to the north. If progress changes and the scope of the first phase of the development is reduced, these figures will be far lower. Traffic to/from the southern building site will use the existing road network to the central airport area. For the northern building site, works traffic will have to use Blikkvegen from the east and Nye Aurveg from the west.

Experience indicates that a majority of the workers will use cars to/from work/building site. Based on the aforementioned figures, an increase in the average annual daily traffic may be expected on the local road network around the airport. The largest share of this traffic must be assumed to enter/exit the airport area to the north, where most of the works-related traffic will go. In addition, deliveries will constitute a significant proportion average annual daily traffic.

The transport of material may constitute the largest strain on the local road network. Excess material from the works is assumed, as of today, to mainly be reused or deposited within the airport area. However, in a worst case scenario it has been assumed that some material will have to be transported from the airport area. In addition there will also be the possibility of asphalt and concrete transport. So far it is not clear whether asphalt and concrete production will take place inside or outside of the airport area or how extensive production will be. Currently there are therefore no production volumes that can be extrapolated to eventual traffic figures/average annual daily traffic on the surrounding road network.

Works roads

It is expected that the bulk of material transport – around 90% – will take place in the area between the works area to the north and eastwards to/from Hovinmoen and the E6 road. The remaining traffic will go west towards Nannestad. The traffic eastwards is assumed to be distributed as 20% to/from the E6 and 80% to/from the Hovinmoen area. Trunk road 461- Blikkvegen, has very good capacity reserves. The current average annual daily traffic on Blikkvegen is a modest 1,000 vehicles/day, and will in the most hectic building period have an additional load of approx. AADT 900. This is still well within the capacity limit. Blikkvegen is also adequately scaled in terms of load-bearing capacity to carry this works traffic.

Traffic, noise and dust – remedial measures

A significant portion of the works traffic may inconvenience the road's neighbours with noise and dust. This will have few consequences for the main part of the road up to Hovinmoen/Lie, but may have significant negative effects for residential areas at Lie.

Remedial measures may be implemented in terms of noise, dust and traffic safety conditions on the existing road, but due to the close proximity to homes, the effect will be limited. A possible solution may be to establish an approx. 800 m long works road on the disused railway line south of the residential area at Lie. Noise screening may be efficiently achieved with a barrier along the entire works road, between the road and homes.

The dust problems may be prevented through dust-binding of the works road, or by considering a closed surface on parts or the whole of the stretch. The noise barrier will also contribute in this respect.
Traffic safety is improved by leading works traffic outside of the residential area. Reduced speed may be considered at the entry/exit area for the works road.
If desirable, the works road past the residential area may in the longer term be upgraded to a permanent national road and be included in the future feeder road network for Gardermoen Industrial Estate, as indicated on the map illustration.
The aforementioned issues will be clarified in connection with further detailed planning.

PREPAREDNESS – RISK AND VULNERABILITY ASSESSMENTS
OSL is as a limited company a separate legal entity and has an independent role toward the authorities in relation to mandatory statutory requirements. As a consequence OSL has a separate system for management and administration of its operations. Through this system, which is based on relevant ISO requirements, quality improvements are ensured, including safety, security, health, environment and the safety of employees.
An overarching Safety and environmental management plan and a Crisis management plan are included as components of this management and administration system. The Safety and environmental management plan describes OSL's subsidiary targets within the areas of Air safety/HSE and Environment/Society, and which activities and measures, beyond regular operations, that are continuously carried out, or whose implementation is planned annually in order to achieve targets. In this there is also an overview of responsibilities and implementation of a number of analyses, audits and exercises.
The Crisis management plan describes the various sub-areas/technical areas within crisis management, and who is responsible for preparing and following up contingency plans within the individual sub-areas. Examples of such sub-plans are; Notification plan (for all types of incidents), Accident and rescue plan, Anti-terror plan, Evacuation plan for the terminal, Procedure for risk and vulnerability assessment, Quarantine/communicable diseases and Contingency plan for the external environment.

<u>RAV analyses/assessments in connection with Terminal 2</u>
The development of Terminal 2 and required RAV assessments in connection with this, both in terms of the building phase and operational phase, are considered to be fully maintained through the existing management and administration system described. Analyses/assessments and relevant remedial measures are otherwise, for certain subjects in the IA, described through the relevant sub-assessments and chapters of the IA. Simulations and risk assessments of different solutions and options have also been carried out during the study and planning work.
In accordance with the Provisions for civilian aviation (BSL), all changes that may affect air safety must be subjected to risk assessments. This is the background for including the requirement toward risk assessments in OSL's management system. The purpose is to uncover risk factors that can be eliminated/minimized through design changes or adaptation of procedures and regulations.
Det norske Veritas has carried out a risk assessment of the approved solution for airside in the Terminal 2 project. This has been done with focus on air safety, and the analysis comprises three main sections with subsections. In the continued planning and implementation work in the project there will be a formal division of phases for the work on airside. Each of the phases will be subject to more detailed risk assessments than those in this general assessment. This will also allow for a more detailed look into certain issues.

CONTINUED PROCESS – IMPACT ASSESSMENT, CHANGE OF PLAN AND PROJECT

Consideration of IA and change of plan

Ullensaker municipality will as planning authority be responsible for the continued consideration of the available impact assessment and proposals for plan changes. This includes consultation/submission to public review of the IA and planning documents, continued final consideration and final decision by the county council. The approved IA and change of plan will form the basis for further applications for measures.

Project progress

The winners of the competition and the planners, including architects, chartered engineers, engineers and a number of other professionals within the various technical disciplines, including from OSL, have already started processing the winning draft, i.e. revising that which through the winning project also may be called a draft project.

This revision is also being carried out in light of current economic situation in society at large, the decline in air traffic in recent times, and thus the need to more closely consider both the progress and scope of the various phases of the development.

The draft project is assumed to be pursued through the drawing up of a pilot project in the autumn of 2009. Thereafter, further detailed planning will take place within the various parts of the project.

Phase plans will be prepared for implementing all structural measures. The phase plans will describe each individual measure in terms of scope, duration, progress, simultaneousness and any dependencies in relation to other measures. As a stage in this, the timing of required permissions from authorities will also be clarified.

Decision to develop

Based on the completed pilot project, which will provide the necessary information on the scope of measures and not least costs, it is expected that a final decision on the development of Terminal 2 will be available at the turn of the year 2009/2010.

1 INTRODUCTION – BACKGROUND

1.1 Background – why Terminal 2

Due to strong growth in traffic, Oslo Airport Gardermoen needs to expand the airport's terminal and aircraft parking capacity such that traffic can continue to operate in a safe and efficient manner. To prepare for this, OSL initiated a separate project in 2007, the Terminal 2 Project, with the purpose of studying and planning the development of a new terminal and aircraft parking stands.

Passenger growth in recent years has been substantially higher than indicated by earlier prognoses, and the passenger total for 2008 was 19.3 million following 10 years of net growth from approx. 13 million at the opening of the new main airport in 1998.
Previous forecasts that formed the basis of the development of the main airport indicated that passenger figures would only reach 17 million in 2010 and just above 22 million in 2020 (median alternative for traffic growth).
The current terminal and aircraft parking is scaled for approx. 17 million passengers, but may by way of certain capacity-enhancing measures satisfactorily serve 22 - 23 million passengers. The ongoing expansion of the terminal to the east is such a measure.
The current traffic figures indicate that more than 50,000 passengers travel through the airport every day, and close to 15,000 people work here. Around 700 aircraft land and depart every day and over 50 airlines operate scheduled, charter or freight services. The route network to and from OSL extends to 100 airports in total, 25 of them domestic.

Forecasts from the Ministry of Transport and Communications (Norconsult/ TØI 2007) that form the basis for assessing the need and timing for development and scale of a new Terminal 2, indicate traffic developments with 25 million passengers in 2015, 30 million in 2020 and 40 million in 2030.
Based on this, the goal was that the first construction stage of Terminal 2 was to be completed in 2013, with a capacity of 28 million passengers. Phase 2 with a capacity of 35 million passengers would, in accordance with the forecasts, be relevant to implement between 2020 and 2025.

Forecasts are always uncertain, and due to the decline in air traffic recently, both the progress and scope of the development in the various stages is currently being reassessed. It will in all likelihood take somewhat longer than previously assumed to reach the passenger figures in the forecasts that formed the basis for previous assessments. OSL is nevertheless of the opinion that it is important to take a long-term view and build for the future. The decline is considered to be of a temporary nature, and in a few year's time there will be a need to increase capacity both on the terminal side and for aircraft parking stands.

1.2 Study and planning process – established study programme

As a stage in the planning and study work it was, following consultation with Ullensaker municipality as the planning authority, clarified that the development of a new terminal would be such a comprehensive measure in terms of both scope and investment that there was a need to carry out an impact assessment in accordance with the provisions of the Planning and Building Act and accompanying regulations. At the same time as it was considered important to study relevant consequences as a result of the traffic growth the forecasts indicate, and that the development is presumed to handle. This applies regardless of whether this is currently considered to take place somewhat later than first assumed.

The proposal for the study programme was developed in the autumn of 2007. This programme described a need for studies of the following subjects:

<u>Consequences for the environment:</u>
- Emissions to air – local and climatic conditions
- Discharges to ground and groundwater balance
- Cultural environment/architecture and design

Consequences for natural resources:
- Use of alternative energy sources
- Material extraction – raw materials for building

Consequences for society:
- health-related consequences – aircraft noise
- Feeder traffic/transport network
- Parking
- Spin-off effects – trade and industry/employment, etc.
- Social economy – cost-benefit assessments

Consequences of the building and construction activities:
- General – description of sites, activities, progress, etc.
- Works traffic – works roads
- Emissions in connection with construction activities; noise, dust, vibrations, etc.

The study programme was submitted for public review/consultation in November 2007, with a deadline of January 2008. 10 statements were received, 5 from public bodies and 5 from others. These were reviewed and commented in connection with the municipality's subsequent consideration of the programme. The study programme was adopted by Ullensaker municipality, through a decision in the Main Committee for Overall Planning (MCOP) on 31 March 2008.
The decision stated the following;
"The announcement of the proposal for study programme provides a good basis to study consequences of the measure. The proposed programme is approved with the inclusion of those issues raised in this case study. MCOP would particularly wish to emphasize the importance of the study of the public transport share to the airport and CO2-neutral energy solutions for the buildings."
(The study programme is attached as attachment 1.)

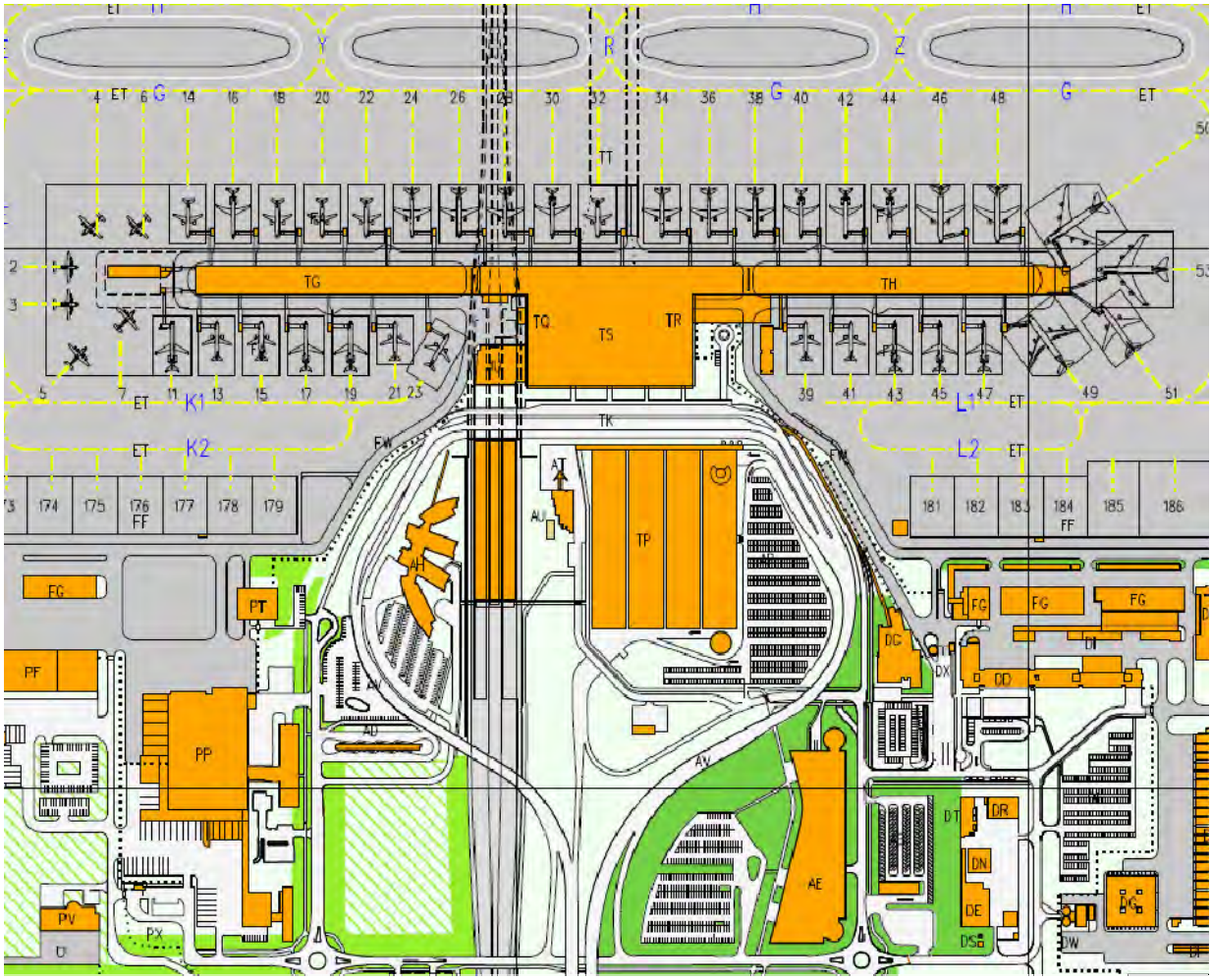
The impact assessment has been carried out in accordance with the stipulated study programme, with those subjects and issues that are presented there and elaborated on through the consultation and the municipality's consideration.
Certain subjects have been subject to somewhat more comprehensive and thorough analyses and assessments than others. For these, only summaries/conclusions from the studies undertaken in this IA are included, as it would be too comprehensive and detailed to incorporate these in their entirety. These studies/reports are however available as attachments.
For certain subjects it has been appropriate to change the titles somewhat and use titles that are more accurate in terms of the final content. All stipulated subjects/issues are nevertheless considered to be discussed and fulfilled in the impact assessment.

In connection with notification and distribution of the planning programme, commencement of planning work for required changes to the zoning plan as a result of Terminal 2 was also announced. It was assumed that the further process for the IA and change of zoning would be coordinated/parallel. Preparation of the necessary planning documents (proposal for change of plan and description of plan) based on the winning entry from the competition will require somewhat more time, so this will be submitted to the municipality following submission of the IA. A more detailed description of relevant planning changes is therefore not included here. However, further coordinated consideration is assumed.

1.3 Description of measure – Terminal 2

1.3.1 Current situation

The below figure/situation plan shows the main access zone and central area as it currently appears, with the existing terminal, piers and aircraft parking stands. Within the main access zone there is the tower, parking facility (which has subsequently been extended eastwards, toward the road loop), and hotel (SAS Radisson) west of the railway tracks and train station.
Currently an expansion of the central building eastwards is being carried out (base area 2,000 m^2) toward the aircraft parking south of the pier, and a hotel is being built on the former parking space south of Flyporten (DC).



Section of general plan of the airport showing existing central area/ main access zone.

The current terminal and piers cover a ground area/footprint of approx. 42,000 m^2, and have a combined floor space of approx. 145,000 m^2. There are currently 34 aircraft parking stands with passenger bridges in addition to parking spaces by the Commuter lounge (at the end of the western pier), as well as remote parking stands for both passenger and freight aircraft. These total 56 aircraft parking stands.

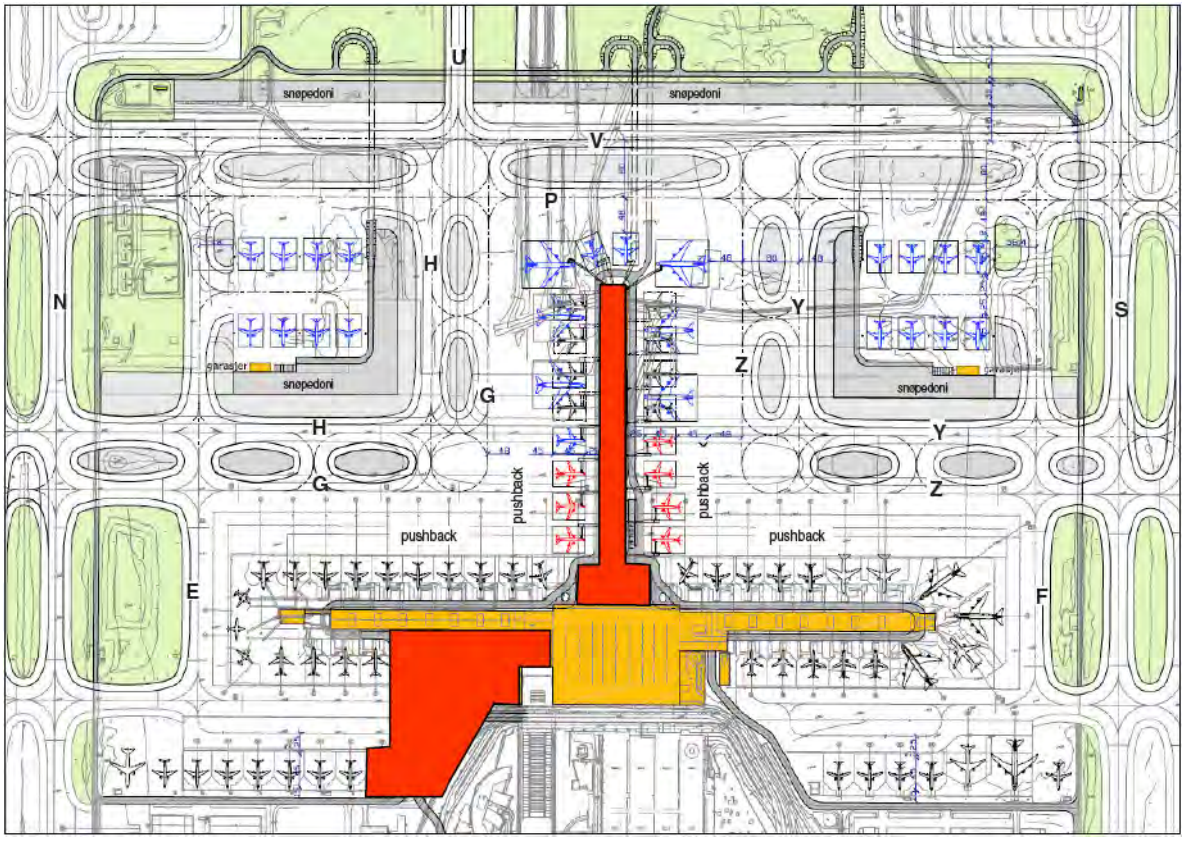
1.3.2 Choice of main concept/terminal solution

Work on identifying possible location alternatives for a new terminal and new aircraft parking stands commenced as early as the autumn of 2006. Following comprehensive assessments and evaluations of functionality, efficiency, costs, access conditions and more, it was concluded that the development of a new terminal and new aircraft parking stands would have to take place in the central area in connection with the current terminal.

In the proposal for the study programme (Nov. 2007), two alternative solutions/concepts were presented for the location of the new terminal and pier, which at the time were considered to be relevant. The alternatives, named A6 and I6, both envisioned an extension of the terminal/central building westwards/southwards from the current central building, with direct connection to the main access zone. Alternative A6 had a detached parallel pier to the north, while alternative I6 had an integrated pier, at a right angle from the current terminal and northwards, and designed as a “T” when fully developed. The programme otherwise stated that the alternatives were being considered and that a decision on choice of solution was to be expected in January/February 2008.

Following further consideration it was decided in March 2008 to use a reworked alternative, V6, as a basis for further assessments and planning. Alternative V6 was a development of the former I6 alternative, and almost identical to this in the initial phase, i.e. with an integrated pier at a right angle northwards, but instead of an extension of the pier as a “T” in phase 2, the pier will be extended due north in phase 2. This alternative also formed the basis for the completed planning competition.

The below figure shows the chosen V6 concept fully developed. In an initial phase it is assumed that a section of a new central building is built, closest to the current central building, and the pier is correspondingly assumed to be built with a certain length in the first phase and to subsequently be extended in the second phase. This was also indicated as external boundaries for a development in connection with the planning competition. As a result that the new pier is proposed to be built at a right angle northwards in relation to the current central building, the existing east-west taxiway north of the terminal must be correspondingly relocated northwards.



1.3.3 Phased development

The competition basis for the planning competition presumed that Terminal 2 was to be developed in two phases. The first phase of the development was to provide capacity for 28 million passengers. It was to commence in 2009/2010 and be completed by 2013. In this phase 10–12 aircraft parking stands with bridges were to be installed, whereof approx. 7 stands as replacements for existing stands that will be lost due to the development of the new terminal/central building. In addition it was assumed that 7-8 remote parking stands were to be developed north of the terminal, based on busing of passengers.

Terminal 2 – phase 2, was intended for a capacity of 35 million passengers. This phase was, based on the available forecasts, assumed to be relevant for construction/completion in the period 2020 – 2025. Phase 2 presumed an extension of the pier northwards with room for a further 4 - 6 aircraft parking stands with passenger bridges. In addition, 8 new remote parking stands were to be established to the north. In phase 2 the terminal/central building was to be extended further westwards.

As previously mentioned, the financial slump has also led to a decline in air traffic in recent months. Even though traffic is expected to pick up, it will probably take somewhat longer than expected before the passenger figures indicated in the forecasts are achieved. There are thus also reasons to more closely

consider both the progress and scope of the development in the various phases. This work has been initiated.
By viewing traffic developments back in time, there is nevertheless reason to believe that air traffic at some point in time will pick up again. It is therefore considered both forward-looking and necessary to prepare for the development of a Terminal 2 in any case.

1.3.4 Description of winning project – selected proposal

Following the completion of the planning competition and subsequent evaluation, the board meeting of Avinor on 12 February decided on a proposed solution for a new terminal. Those responsible for the proposed solution/winning project, called TerminalEN, comprised the following cross-disciplinary team:

- Narud Stokke Wiig Arkitekter og Planleggere AS
- COWI AS
- Norconsult AS
- Ingeniør Per Rasmussen AS
- Dr. Ing. A.Aas-Jakobsen AS.

In connection with the Terminal 2 project, these have established a new company, TEAM_T AS, which also includes a number of sub-consultants.

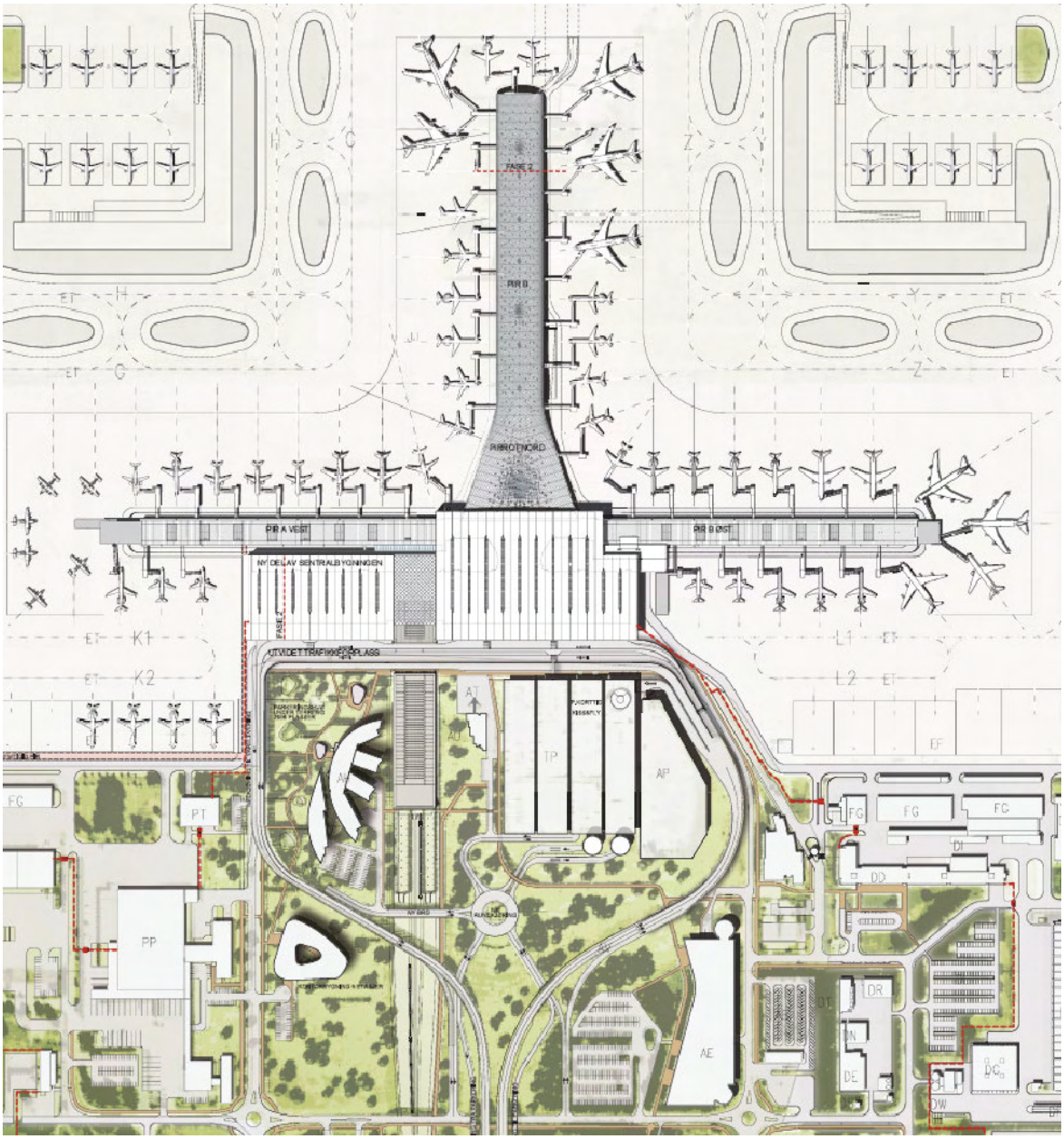
Design of new terminal
The existing terminal at Oslo Airport is considered to be well-functioning and rational, and one of the most efficient compared to other European airports. The explanation is that there is one centralised terminal with a very straightforward design. The winning team has based their design on this, with an aim to maintain and strengthen this efficiency and simplicity.

Based on this, the winning project proposes to build Terminal 2 as an extension of the current terminal/central building westwards, such that there will be only one terminal consisting of one central building with one check-in hall, one domestic baggage hall and one international baggage hall. A new pier is to be built at a right angle northwards from the current central building, with one central common pier root in relation to the existing piers to the west and east. This means that passengers will only have to negotiate one terminal building.
The railway station will be used to separate the two central building sections and the walking distance from the station to check-in will be as short as possible. The pier root has been given a triangular shape to improve passenger flow and traffic movement at ground level. In this way, the proposal maintains one of the main advantages of the current terminal, which is the short distance from check-in to gate.

Area sizes of new buildings (all figures are approximate)
In the proposed solution the new terminal/new central building will be extended west of the railway station with a base area of 12,000 m^2 in phase 1 and further extended by 3,250 m^2 in phase 2. The gross floor area of all levels will for the new central building constitute a total of 42,000 m^2 in phase 1, and be extended by 10,000 m^2 in phase 2.
The new pier is proposed to be built with a length of 380 m northwards with a base area of 19,000 m^2 in phase 1, which is extended/expanded by 90 m/4,800 m^2 in phase 2. The gross floor area in all piers, all levels included, constitutes 71,250 m^2 in phase 1 and is extended by 11,000 m^2 in phase 2.
In total this is a total base area ("footprint") for the development of 31,000 m^2 in phase 1, which is extended by a further 13,250 m^2 in phase 2. (The existing terminal and piers is 42,000 m^2)

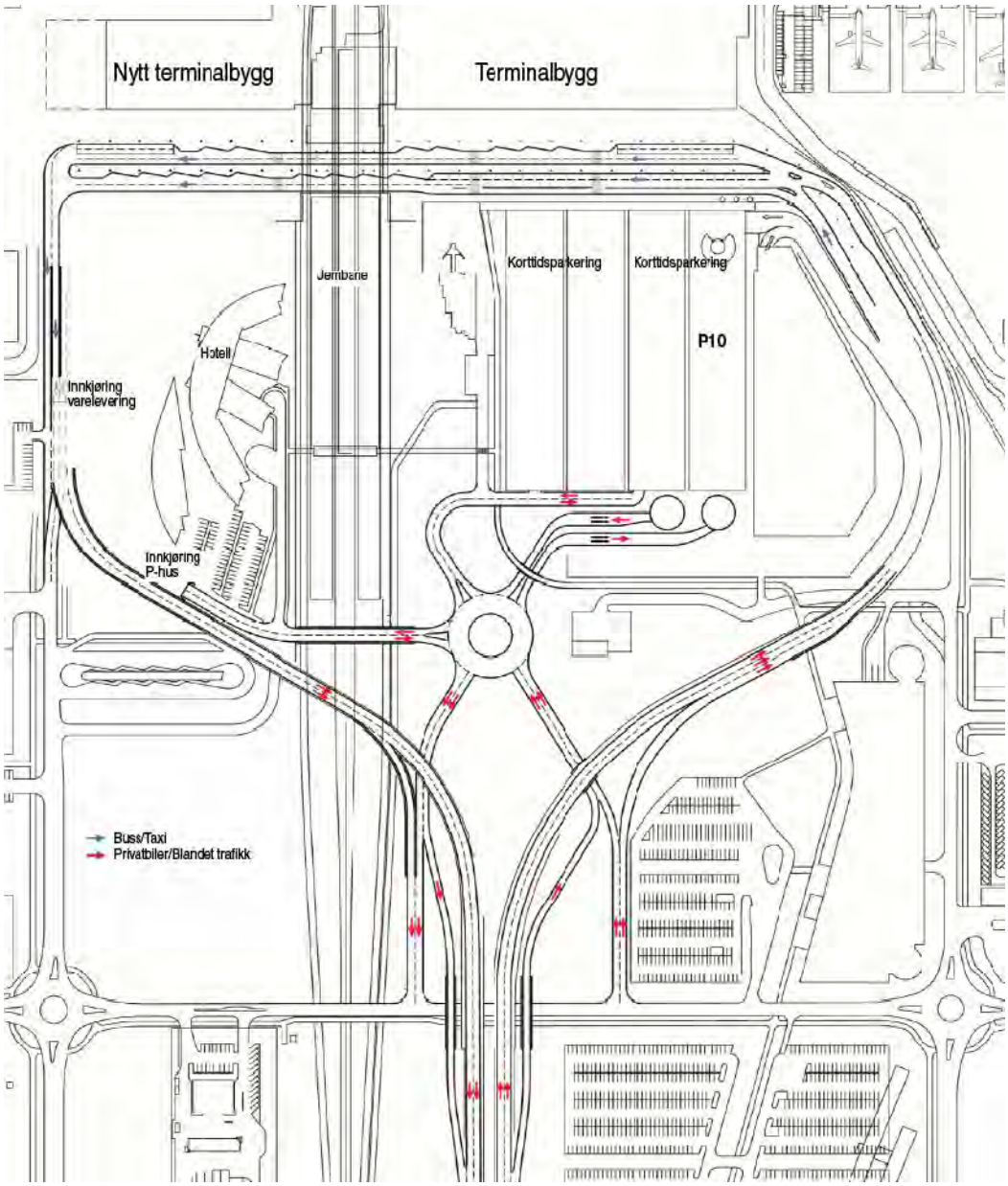
The project also demonstrates a possible future underground parking garage, between the hotel and the extended road loop to the west, as well as an office building south of the main road loop to the west. These are however not included in the development that is presumed to take place in connection with Terminal 2.

Illustration/situation plan from the winning project, which shows the new development – phases 1 and 2.



Access and road system
The current traffic system is simple and easy to follow and generally provides a satisfactory traffic flow, but problems sometimes arise on the plaza, particularly at the entrance and exit to the short-term parking. This is related both to capacity in the case of heavy traffic and because the signs are not followed/understood.

In order to achieve a better future traffic situation, the winning project proposes a new design of the road system, with changed access to and from the short-term parking and parking garage. It is proposed that access here should take place directly from the main road via new ramps south of the main road loop, and should be distributed via a centrally located roundabout south of the P10 parking garage.
The departure and arrival plazas are extended at the same levels as today and mainly with the same widths as in front of the current terminal, and traffic flow at the top plaza is simplified and dedicated for buses and “kiss & fly”. This solution will provide car and bus passengers with a simpler traffic situation, while also providing what is considered to be a much safer traffic solution.
In the current assessment of progress and scope of the development in the various phases, a staged development of the road system is also being considered.



Illustrasjon som viser forslag til nytt vegsystem i hovedadkomstsonen.

Universal design
One of OSL's main objectives for Terminal 2 and for the planning competition has been that the new terminal should have good and integrated universal design solutions. In connection with this, references were made to the Design manual, the Guideline for Universal Design drawn up by Ullensaker municipality, and the Quality plan for the entire air journey, prepared by the Forum for accessibility to air travel.
The winning project may be said to have fulfilled this requirement well, among other things through the use of compact solutions, short distances, good orientation and minimal vertical movement. A description of lighting systems to maintain universal design is also included. Further details and designs will emerge and are presumed to be maintained in the continued planning work.

Material use and structures
Based on a desire to establish one common terminal, the winning project has chosen to continue existing material use, with load-bearing structures in steel, the use of glass in the façades and wood in the roof structures. Material use has been developed and updated through new methods, technology and new products that provide opportunities for new interpretations of the existing that has not previously been possible. The same applies to indoor material use through the use of stone floors, wooden ceilings and wooden panelling.
It is proposed that the roof of the central building is built using laminated wood beams as in the existing building. A laminated wood load-bearing structure is also proposed for the railway station, but in this case as a “diagrid” system, where wood beams are positioned diagonally in a framework. The same roof structure is to be implemented in the new pier. Much emphasis has also been placed on energy efficiency through the choice of materials and design of the building and structures.

Illustration from new pier at arrival level.

Illustration showing the plaza at the departure level with new central building extended westwards from existing central building. New central building with same material use, roof design and scale as original.

Illustration showing the station hall with escalators from arrivals and up to departures level. Existing central building to the right and new to the left.

2 GENERAL PLANS AND PREMISES

2.1 Zoning plan, development plans and “internal” planning and management documents

Zoning plan and development plans

The government zoning plan for the main airport was adopted by the Ministry of Transport and Communications in 1993, and was revised in 1995. This and subsequent adopted development plans for zones/sub-areas, form the basis of the development that thus far has taken place within the airport area. In the adopted zoning plan, all areas, with the exception of the Norwegian Armed Forces' area to the north and a few minor conservation areas, are regulated as public traffic areas. The public traffic areas comprise the runway area, zone for buildings requiring a development plan, zone for buildings with no development plan requirement, roads, railway and the combined purpose of airport/railway/road. Cf. attachment; photographed copy of zoning plan.

Environmental follow-up programme - environmental management system

Through the Storting's consideration and decision on development of the main airport at Gardermoen, it was assumed that a separate environmental follow-up programme was to be developed for the airport. The programme was to deal with the issues of noise, air, local climate, earth and forest resources, water resources, outdoor recreation, landscape, loose material and flora and fauna. The purpose of the programme was that this would be a management tool for the developers, it was to form the basis for drawing up the environmental specifications in the contracts and also be used by authorities in follow-up and control of the development.

The Environmental follow-up programme was first approved in September 1993, but has subsequently been revised. A requirement for such a programme was also included as a part of the first operating licence in 1998. This requirement has been replaced with a requirement that OSL must have an environmental management system in the new operating licence issued in 2003. It is the important environmental aspects of noise, water, ground, air, waste and energy, in addition to statutes, regulations and permits, that constitute the framework conditions for the environmental management system. The environmental management system has its basis in OSL's general management and administration system and it is also assumed to form the basis of the Terminal 2 project, where a separate environmental follow-up programme will be developed.

Design manual

When the decision was made to develop the main airport at Gardermoen, much emphasis was placed on ensuring that the development would employ the highest possible quality for architecture and design. A separate design manual was therefore prepared at an early stage, which provides general guidelines for a common and uniform design that emphasizes aesthetic quality and which describes the procedures that must be followed in order to achieve this. The manual consists of a general section and four series of theme booklets; Architecture and landscape, Graphical identity, Design of signs and Commercial activities. Within each of these, detailed sub-booklets/descriptions were developed.

The design manual was first published in 1995 and has subsequently been supplemented and updated within the individual series/themes. It has the status of governing document at OSL and forms the basis of all planning and construction measures at the airport.

Airport plan for Oslo Lufthavn AS

An Airport plan was developed for Oslo Lufthavn AS in 2001-2002. This is a comprehensive plan that shows the expected development of the airport in the short and long term and describes general land use as well as operation of aviation and operational conditions. The plan emphasizes the long term development requirements, development patterns and sequence, with an aim to avoid enclosing buildings, and to ensure that the potential for business development in the host municipalities and region is maintained.

The Airport plan has no formal basis in legislation, but is intended at all times to be governing for general development of the airport and guiding for further planning both within and outside of the airport area. Planning work was carried out in dialogue and cooperation with the surrounding municipalities, the County Governor, county municipality, Civil Aviation Authority, the Armed Forces and others. A revision of the plan is currently being prepared.

Environmental considerations were an important precondition to complete the work with the airport plan. In connection with the airport plan, a separate report called “Envionmental status and assessment of third runway” was therefore prepared. This report summarizes the environmental assessments of the alternative locations one has arrived at for the third runway and the land use proposed in the Airport plan. The environmental assessments are also intended to form the basis for any subsequent impact assessment.

Restriction plan
The Restriction plan was adopted by the Ministry of Transport and Communications in June 1998, and ensures obstacle-free airspace for aircraft in specified oblique, horizontal and curved planes from the runway, and also ensures the functionality of navigation instruments. Stipulated restriction elevations and restriction areas are apparent from separate map appendices. The plan is assumed to form the basis of and be complied with in the case of all developments within and beyond the airport fence.

Land conservation plan
In 2005 Avinor started work on a land conservation plan. The backdrop was Proposition to the Storting no. 1 (2001–2002), which stipulated that all governmental bodies and ministries must review their buildings with an aim to manage cultural-historic properties.
Avinor's land conservation plan represents a combined overview of cultural monuments and cultural environments at the airports, and in this Avinor proposes to protect the tower and parts of the terminal at Oslo Airport Gardermoen as important aviation and architectural buildings from the late 1990s. The buildings are typical for their period in terms of aviation and have significant architectural qualities. The conservation plan was submitted to the Directorate for Cultural Heritage for consideration in February 2009.
The development of Terminal 2 is discussed in a conservation plan context, and the plan assumes that planned extensions in connection with Terminal 2 will not be included in protection.

2.2 General plans and guidelines from public authorities

2.2.1 National Transport Plan (NTP)

The National Transport Plan is drawn up and revised every four years. The proposal for National Transport Plan for the 2010–2019 period with recommendation from the Ministry of Transport and Communications of 13 March 2009, was approved in a cabinet meeting the same day, as Report to the Storting no. 16 This Report to the Storting is to be considered by the Storting in the 2009 spring session.

The proposal for National Transport Plan is based on the governmental transport bodies' and Avinor AS’ professional recommendations, which in turn are based on guidelines from the Ministry of Fisheries and Coastal Affairs and the Ministry of Transport and Communications from 2006/07. The transport bodies have as a stage in this work each prepared a sector plan that describes needs and possible strategies for development of the transport network in a 30-year perspective.
The volume of transport has increased in time with economic development and globalization. At the same time, transport has negative effects on the environment and safety. Since the time of the last transport plan, climate challenges have significantly increased, and the government has presented its climate report with sectoral action plans.
The main task of Norwegian aviation is to contribute beneficially to social development in Norway by providing safe, efficient and eco-adapted air transportation within all regions of the country and to make arrangements that enable the nation to participate actively in global economic and social development. In the proposal for a National Transport Plan the following general political targets for the transport and communications sector are set: “To offer an efficient, accessible, safe and eco-friendly transportation system that covers society’s need for transportation and promotes regional development”.
In the National Transport Plan it emerges that Avinor is facing significant investments related to government requirements towards air safety and measures against terror and sabotage. In order to meet increasing demand, there will also be a need to significantly expand capacity at airports and in air navigation services. This also includes the need to expand capacity at Oslo Airport Gardermoen.

2.2.2 County plan, county sub-plans and municipal plans

County sub-plan Regional development Romerike – Romerike meets the future

County sub-plans provide guidelines for county municipal activities and provide guidelines for municipal and governmental planning and activities in the county. As a stage in the county planning work, a county sub-plan has been prepared; Regional development plan for Romerike 2005–2025 – Romerike meets the future. The county sub-plan dated October 2004 is a continuance of the previous county sub-plan and deals with development in Romerike in the very long term. It is a specification of national political guidelines for coordinated land and transport planning, with goals and guidelines for development patterns and land use in Romerike. This discusses Gardermoen and spin-off effects both in terms of employment/jobs, housing developments and transport/ public transport coverage.

Strategic development plan for Gardermoen – Gardermoen 2040
As a follow-up of the aforementioned county sub-plan and OSL's Airport plan, a strategic development plan for Gardermoen has been prepared; Gardermoen 2040. This seeks to unite the priorities of Romerike meets the future and the Airport plan, such that both the region and the main airport can develop to the benefit of each other. The plan has been drawn up under the management of the county municipality, but also includes participants from Oppland and Hedmark county municipalities, the airport's host municipalities (Ullensaker and Nannestad), Øvre Romerike Utvikling (ØRU), NHO, OSL, Avinor, etc. The plan has, as apparent from the title, its main focus on Gardermoen in a long-term perspective; how the airport can make a positive contribution towards the region's development, be a national hub and a showcase for the world. The airport must contribute toward regional development in the area by promoting industry and developing expertise. Gardermoen must further be the leading eco-airport in Europe through reduced energy consumption and emissions of greenhouse gases. The plan was considered by the county council in February 2008 and has been forwarded to the Ministry of the Environment.

Both the Strategic development plan for Gardermoen and the Airport plan signal the need for increased capacity at the main airport through the expansion/development of a new terminal in 2012, and an increase in runway capacity in the longer term, somewhere between 2020 and 2040.
The different spin-off effects described in the plan are discussed in the IA under chap. 3.5 - Consequences to society – spin-off effects.

The Ullensaker and Nannestad municipal plans
As host municipalities for the main airport, development and operation of the airport has provided and continues to provide major spin-off effects and challenges to the municipalities in terms of housing development, industrial development and the provision of various infrastructure. The consequences of this and how the municipality handles this in the various areas is reflected in the respective municipal plans. Nannestad municipality's municipal plan for the 2007 – 2018 period was adopted in July 2007. Circulation of the plan has been initiated.
With respect to Ullensaker municipality's municipal plan for the 2008 – 2020 period, the social part was adopted in June 2008, and the land use part was adopted in March 2009.

2.2.3 National political guidelines

NPG for coordinated land use and transport planning
The guidelines (of 1993) must form the basis for planning and exercising authority in accordance with the Planning and Building Act. The purpose of the guidelines is to achieve better coordination of land use planning and transport planning. Land use and transport systems must be developed such that they promote socio-economic and efficient use of resources, using environmentally beneficial solutions, safe local communities and living environments, good traffic safety and efficient traffic development. A long-term, sustainable perspective must form the basis in planning and emphasis must be on achieving good regional general solutions.

NPG for planning in connection with the main airport at Gardermoen

Based on the size and significance of the main airport, national political guidelines were stipulated for the project by royal decree in January 1991. Revised guidelines were stipulated in March 1994. These guidelines were valid for 10 years, i.e. until March 2004, but are nevertheless mentioned here as the guidelines that were provided are present in previous planning and study work that still forms the basis for some of the activity at the airport.

The guidelines were initially intended to form the basis for planning in all municipalities affected by the Gardermoen development, for the relevant county municipalities and national authorities. An overarching goal was that development patterns and transport systems were to be coordinated and developed in such a way that ensured efficient and safe traffic and good land use, and which promoted increased public transport, traffic safety and good social economy. Among other things, it was specified that the feeder system to the airport was to be planned for the best possible eco-friendliness and transport economy for the region as a whole. As a stage in this, the goal was a public transport share of at least 50% for air passengers.

Special guidelines were also provided for planning in the airport's local area and reference was made in particular to the guidelines that then applied to land use in aircraft noise zones, with charting of the relevant aircraft noise zones. It was further specified that the groundwater resource must be protected from pollution and that the groundwater balance must not be changed so that special natural assets in the Gardermoen area were not depreciated.

3 ASSESSMENT OF CONSEQUENCES

The impact assessment has been carried out in accordance with the study programme that was adopted by Ullensaker municipality on 31 March 2008, and as reiterated in section 1.2.

3.1 Previous study and planning work in connection with the main airport development

In June 1990 the Storting decided that Gardermoen was to be planned as the new main airport for the eastern Norway region. This was followed by a comprehensive planning and assessment process for the various transport measures; airport, road and railway, with primary focus on consequences of the measures on the environment, natural resources and society. This planning and assessment work formed the basis for the Storting's decision in October 1992, on localization of the new main airport at Gardermoen. The assessment work that was carried out comprises a number of technical reports for the various measures, and is summarized in a report from the Ministry of Transport and Communications from December 1991; “Gardermoprosjektet – Samlet framstilling av Hovedplaner for flyplass og tilbringersystem, Konsekvenser for natur, miljø og samfunn og Konsekvenser for forsvaret” (The Gardermoen project – Combined presentation of Main plans for airport and feeder system, Consequences for nature, environment and society and Consequences for the Armed Forces).

3.2 Method for studying and assessing consequences – basis for comparison

Much of the aforementioned assessment work from the main development is considered to have significant relevance for further development at Gardermoen. Subsequently, both during the development period for the main airport and following operation in 1998, a number of analyses, assessments and studies have been carried out on the effects for business, employment and housing development. Economic evaluations and travel surveys have also been carried out, among other things.
Some studies have been carried out by Avinor and OSL, some by the county in connection with county planning, some regionally through Øvre Romerike Utvikling and some on the part of the municipalities in connection with municipal planning work. In the case of studies and analyses of individual subjects and the consequences of Terminal 2, some of this material has been reviewed and used as the basis for the assessments made. For an overview of relevant studies/reports, refer to the attached list of sources.

When studying the individual themes it has not been considered appropriate to weight and compare consequences with a 0 alternative, which is often the case when carrying out impact assessments of new measures. In this case we have a situation with an existing facility with extensive buildings and technical facilities, carried out in accordance with applicable plans and stipulated premises. The development of Terminal 2 will take place in connection with the existing terminal and within the area regulated for the purpose. The building volumes are also well within the limits provided by the applicable zoning plan. The impact assessment is therefore at least as important in terms of the consequences of traffic growth that is taking place faster than expected, as for the actual development. This applies even though the zoning plan originally was designed for significant growth through the development potential inherent in plans and provisions. In connection with this, reference is made to the zoning plan and the development boundaries that indicate the location of a pier B and pier C parallel and north of the existing terminal, as well as the regulated development areas south of the central area that remain undeveloped.

The study programme discussed the basis for comparison/0 alternative as use of the existing terminal, with an eventual limited expansion of this, within the framework of the zoning plan. In light of the fact that the current zoning plan provides an opportunity for a significantly larger development than what is currently developed, it is considered most appropriate, for purposes of comparison, to use only the current buildings and other facilities (incl. ongoing extension of central building), and the limitation this will have for activities in that, with the current traffic pattern, it will only be possible to handle a maximum of 22–23 million passengers. In accordance with the traffic forecasts, capacity at OSL could thus reach capacity some time between 2012–2013, and following newer, ongoing assessments, probably somewhat later. A comparison/assessment has not been carried out for every theme. Emphasis has been on evaluating consequences of increased traffic growth/activity in relation to the current status and with a description of follow-up – proposals for measures. For certain themes only the measure/activity is described. Studied subjects and conclusions are summarized and collected in a separate table in chap. 4

3.3 Consequences for the environment:

Oslo Airport Gardermoen is Norway's largest and most important traffic hub, as well as one of the country's largest workplaces. As a means of collective transport, air travel meets important needs in society for long-distant transport. Like all transport activities, air travel has a negative impact on the environment. OSL's policy is that the environment must be taken seriously and that the effect must be reduced as far as possible. OSL has therefore made sustainable development of the airport one of its main priorities, where growth and efficiency are balanced against social and environmental considerations. As airport operator, OSL thus has great responsibility toward society and constantly works to satisfy requirements and expectations that are imposed. Among other things, this is maintained through OSL's environmental management system and there is also strong focus on the environment and sustainability in the planning, construction and operation of a new terminal.

3.3.1 Emissions to air – calculation of air quality

Introduction
Local air quality at Oslo Airport Gardermoen is primarily affected by road and air traffic, but also by the heating of homes and other individual sources. Emissions to air from OSL's fire drill site and energy plant are among the issues that are regulated through an emission permit from the Climate and Pollution Agency.

The Pollution regulations' chapter 7 imposes requirements toward air quality in the form of limit values for concentrations of particulate matter, carbon monoxide, sulphur dioxide and nitrogen dioxide. There are limit values for both annual average concentration and for maximum average concentrations for shorter periods, from one to 24 hours, depending on pollution component. Certain limit values may be exceeded a certain number of times per year.

In 2001 NILU was tasked with calculating local air quality. The concentration distribution of a selection of components was calculated for one winter month and one summer month. The distribution maps formed the basis for a monitoring programme, and since 2003 OSL has operated a mobile facility for continuous monitoring of air quality. These results are reported annually and are available on OSL's website.
The monitoring facility has since November 2006 been located at the south-western corner of the airport at southern Gardermoen, close to the Norwegian Armed Forces Aircraft Collection. Previously the facility was located further north alongside the western runway, close to the fire drill site and the Kneppefeltet housing estate. At the end of 2008, only one limit was exceeded in a period of four years, for particulate matter.
NILU's dispersal map from 2001 showed somewhat significant local variations in air quality at the airport, both geographically as a result of areas with different activity, and seasonally as a result of weather and climatic conditions.

A subject associated with local air quality is greenhouse gas emissions. On a global scale aviation contributes with emissions of greenhouse gases, which in turn contribute to global warming. Both the global and domestic greenhouse gas emissions from aviation constitute approx. 2% of total emissions. Slightly less than 1% of aviation's greenhouse gas emissions in Norway are a result of airport operations. Both aviation's total greenhouse gas emissions in Norway and the share related to airport operations are expected to decrease by 2020, compared to the 2007 reference year. This will happen despite the significant growth in traffic that is expected in the period. (Ref. Bærekraftig og samfunnsnyttig luftfart - 2008 [Aviation in Norway – sustainability and social benefit]).

OSL annually calculates its greenhouse gas emissions expressed as CO_2 equivalents, in accordance with established international standards. The climate accounts identify direct emissions from own activities, purchased electricity, in addition to indirect emissions from selected activities such as business travel and travel to and from work by employees. A plan of action for the reduction of own emissions was adopted in 2008.
OSL also compensates for emissions that cannot be reduced through measures in its own activities by investing in UN-approved projects in India. Greenhouse gas emissions are not a part of the local modelling of local air quality. For more information on OSL's climate work, refer to the environmental annual reports. (www.osl.no)

Air quality calculations – Terminal 2

In 2008 OSL procured customized software for modelling emission volumes and dispersal of air pollution (EDMS – Emissions & Dispersion Modeling System).
On behalf of OSL, KB Environmental Sciences, Inc. used this software to carry out a study of air quality at Gardermoen in 2007, as a basis for scaling and modelling air quality for the years 2012 and 2025.
The EDMS software is customized for airports, which calculate total emission volumes and dispersal models for concentrations of different constituents. EDMS can calculate total emissions and analyse the geographic distribution of concentrations from pre-defined sources of different emission constituents.
The combined emission volumes are estimated to be approximately proportional to the traffic volume. The calculations for 2025 show that the limit values for NO_2 and PM_{10} may at times be exceeded at central locations at the airport. However, this result is based on an extrapolation of the current traffic pattern and runway use. Following introduction of the Civil Aviation Authority's proposal for new approach and departure regulations, traffic will be more evenly distributed and the risk of reaching excessive values will be reduced. It is also important to note that the calculation model extrapolates current aircraft and machinery, and thus does not take into consideration technological improvements or electrification in the period up to 2025.

Follow-up – measures to limit emissions
Calculations carried out for the current situation show higher values for emission concentrations that what is apparent from actual measurements. However, OSL uses the most stringent calculation results as a basis for further measures and follow-up.

Central emission-reducing measures will be:

- The sector has already initiated several processes to reduce the consumption of fossil fuels. Examples may include aircraft taxiing using one engine, a transition to biofuels and electrification of ground vehicles. Such measures will have a positive effect on emissions from the airport.
- OSL has also adopted a plan for the reduction of greenhouse gas emissions at the airport, which will also reduce other emissions.
- OSL has decided to extend the air quality monitoring programme based on the calculation results, and will follow developments closely.

3.3.2 Consequences for water and ground, waterways and pothole lakes

Introduction
Oslo Airport is locate on the top of parts of the groundwater reservoir that covers an area approx. 100 km^2 in size. In the north-eastern parts of the airport area the groundwater flows towards this groundwater reservoir and on to Hersjøen lake. This area also contains a system of small lakes (pothole lakes) that are in direct contact with the groundwater. In the south-western parts of the airport, the groundwater flows toward the ravine system and the Sogna and Vikka rivers.

Oslo Airport holds a discharge permit from the Climate and Pollution Agency and a licence from the Norwegian Water Resources and Energy Directorate (NVE) with terms that regulate the operation of the airport such that the water resources are not affected. Technical installations such as de-icing platforms, water and drainage systems and tank facilities are designed and operated in order to comply with the terms. OSL annually reports operation data and results from the Control and Monitoring Programme.
The current systems are designed so that the bulk of collected surface water is returned to the groundwater reservoir. Surface water from the western side of the airport is led to the Sogna river via three culverts along with groundwater pumped from the railway line and the western runway. Polluted surface water from the de-icing platforms and the central area (the large aircraft parking area around the terminal) is collected during the winter and treated at the Gardermoen treatment plant, while some used glycol is transported from the area and used as a source of carbon in the nitrogen treatment process at municipal sewerage treatment plants.

Surface water that may potentially contain oil (from areas where aircraft fuelling takes place) is treated in oil separators and dedicated soil treatment plants for hydrocarbons. In addition, dedicated solutions have been established for these areas, where emergency routines are in place in case of spills and accidents, including separate emergency pipes and collection pools.

New facilities that affect water management will be established in connection with the development of Terminal 2. This primarily applies to new aircraft parking areas and taxiway systems, in addition to new roof surfaces. In addition there will be a general increase in the number of passengers, aircraft movements and activity at the airport, which is significant for overall water management at the airport.

The impact assessment for water and ground includes issues that can be directly related to the Terminal 2 development, in addition to issues that are caused by a general increase in the number of aircraft movements, passengers and general growth.

Water balance
The construction of Terminal 2 will lead to changes in land use and infiltration patterns within Oslo Airport's zoning area. First and foremost because areas that currently have grass vegetation with natural infiltration will have closed surfaces, and in addition some of the current areas will be redefined with respect to water management.

The general water balance is shown in the figure on the following page.

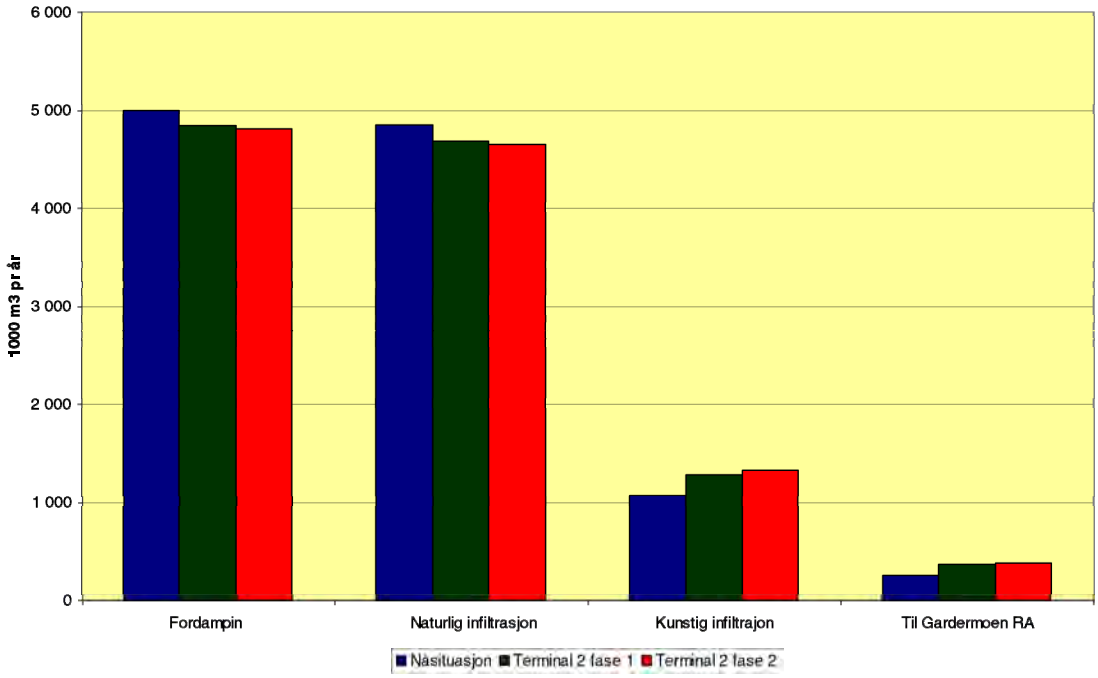


Figure: Water balance – evaporation, infiltration and supply to Gardermoen treatment plant.

The figure shows that there are only minor changes to the different sub-streams. Reduced evaporation due to an increased share of closed surfaces is compensated by an increased water volume to Gardermoen treatment plant. Reduced natural infiltration is compensated by increased artificial infiltration.

General plan for water management
OSL has prepared a general plan for water management where the primary focus has been to obtain an overview of the main characteristics of future surface water solutions including Terminal 2, with particular focus on polluted surface water, i.e. water from de-icing platforms containing glycol, water from aircraft parking areas and taxiways containing formate and surface water from areas where oil and fuel spills may occur.

<u>Clean surface water</u>
Clean surface water from areas where chemicals are not in use must infiltrate the ground and be led to the groundwater to ensure compliance with NVE's terms related to groundwater balance. NVE has imposed demands that the groundwater level and flow of groundwater outside of the airport area must not be affected by airport operations. This is ensured through the choice and planning of technical solutions.

Surface water containing oil
All new areas with a potential risk of generating surface water containing oil must be treated in oil separators with emergency capacities followed by treatment in soil treatment plants/sand filters and infiltration to ground/groundwater or discharge to waterways.

Surface water containing glycol
Terminal 2 will in itself not generate increased glycol consumption as there will not be changes to the existing de-icing platforms. The general increase in aircraft movements will however entail an increase in glycol consumption. De-icing chemicals are for the most part (80%) collected at and around the de-icing platforms. This will be solved through increased pump capacities and storage volumes. The remainder is spread along the runways (approx. 10%) or transported by the aircraft away from the Gardermoen area. Surface water containing glycol that is spread along the runway systems is treated in the unsaturated zone. See section below concerning groundwater quality.

Surface water containing formate
Surface water from aircraft parking areas and taxiways around the terminal building contains formate during the winter. This water is collected and currently led to large retention basins before being led to the municipal network and treated at the Gardermoen treatment plant. The same principle is intended for Terminal 2. In connection with this, more retention basins must be built.

Gardermoen treatment plant
As OSL's water management affects the capacity and use of the Gardermoen treatment plant, OSL's general plan work included an assessment of the treatment capacity at the municipal treatment plant. The study was carried out in close cooperation with Ullensaker municipality. The conclusion of this work is that the plant's capacity is sufficient to treat the agreed glycol volumes and that these will not be exceeded as a result of the T2 development. The increase of surface water containing formate will require an increase in treatment capacity toward 2018--2020. Development of the Gardermoen treatment plant will solve this issue.

Groundwater balance
Oslo Airport is to be operated in accordance with requirements that the natural water balance is not altered in areas outside of the airport's zoning area. I.e. there must be natural variations in groundwater level and groundwater flow. Within the airport's zoning area the groundwater balance is manipulated through lowering of the groundwater under the railway and western runway through drainpipes, and through artificial infiltration of surface water. Changes in land use from green areas to large, impervious surfaces may also affect the groundwater balance.

The water balance, and not least changes to the water balance as a result of the two phases of the T2 development are shown in the figure on the previous page. The water volumes presented in the figure are based on average precipitation of 550 mm in summer and 300 mm in the winter, totalling 850 mm. Further, evapotranspiration equal to 57% annually for grass-covered areas is used based on NVE's research work at Moreppen (Colleuille & Haugen, 2007). On impervious surfaces an evaporation rate of 20% is used for the summer and 10% for the winter.

As apparent from the figure on the previous page, the share of natural infiltration within the zoning area will be reduced as a result of larger areas with impervious surfaces. This will be countered by greater artificial supply of water to the groundwater reservoir. In total the net annual infiltration within the zoning area will increase by 51,000 m^3 following phase 1 of the development, and a further 12,000 m^3 (totalling 63,000 m3) following phase 2. This corresponds to 3.85 mm and 0.89 mm (4,73 mm) net infiltration respectively distributed over the entire zoning area.

The location of new infiltration areas must be determined in detailed planning to ensure compliance with the general requirements. It must also be ensured that flow directions and groundwater volumes are not altered.
In order for the system to be flexible, it is also assumed that possible excess water is retained before being discharged to the Sogna river via the culvert systems.

Groundwater quality

In current requirements toward groundwater quality it is presumed that deicing compounds are not detected outside of the airport area. Within the zoning area small amounts of deicing compounds are permissible in the deicing season, but these must not be detectable before the start of a new deicing season. Additionally there are requirements towards maximum concentrations of hydrocarbons in the groundwater.

Influence from deicing compounds

The use of runway deicing compounds on taxiways will increase. New taxiway systems with runoff to green areas will not be built, which entails that dispersal of runway deicing compounds to green areas will not increase. The new taxiway systems in connection with the aircraft parking areas will have full collection of all surface water containing deicing compounds. Results from monitoring of the groundwater quality show that in some areas of the airport there is a general increase in certain inorganic parameters such as Ca, Mg and K. There are probably several reasons for the changes. These may be:

- The ground heating system, which affects the groundwater temperature locally. This in turn leads to chemical changes in the groundwater quality.
- Dispersion of aircraft deicing compounds along the runway systems. Addition of inorganic compounds in the deicing chemicals (particularly potassium), and chemical change to water quality as a result of decomposition of deicing compounds.
- Fertilization of the areas adjacent to the runway systems. Fertilizing must be carried out in order to optimize the decomposition process. Among other things, fertilizer contains nitrogen, phosphor and calcium that may indirectly affect water chemistry.
- Infrastructure. Extensive concrete surfaces and concrete structures (pipes and basins) may cause washout of calcium, among other things. This will affect water chemistry.

Monitoring also shows an increase in the content of iron and manganese in the groundwater locally in limited areas along the western runway. This change in the chemical composition of the groundwater is due to the decomposition of deicing compounds over time.
In connection with establishing Terminal 2 and a general increase in traffic volumes, a continued increase in these parameters is expected. OSL works continuously to keep the situation under control. Operational and technical measures are continuously considered in established and new projects. Amongst other things, the decomposition process of deicing compounds in the ground and groundwater are being studied further.

Influence from hydrocarbons (petroleum products)

Terminal 2 will increase the areas with potential risk for hydrocarbon discharges , particularly in connection with aircraft refuelling.
These areas will have the following barriers and technical solutions to prevent affecting the groundwater:

- High level of preparedness to prevent any spills from reaching infrastructure or ground/groundwater.
- Surface water from these areas is treated in oil separators with emergency capacities to reduce the oil content of water that is passed on.
- Surface water that has passed oil separators is treated in dedicated soil treatment plants for hydrocarbons and added to the groundwater reservoir.

Monitoring of groundwater quality will document the system's efficiency.

Waterways
OSL currently holds a permit to discharge diluted surface water containing chemicals to the Leira river. For Sogna the permit is based on “zero effect” on the waterway.
OSL has hired Aquateam AS to prepare the “Impact assessment of the condition of the Sogna and Leira rivers as a result of Terminal 2 at Oslo Airport”. The assessments comprise consequences of increased use of chemicals and increased activity related to passenger flows and airport-related activities within the airport's regulatory area.
On the part of the Leira river the consequences of increased flow of discharge water from the airport area and increased influence from surface water containing chemicals to the Sogna river is assessed. Calculations show that the Gardermoen treatment plant's contribution to phosphate concentrations in the Leira river will not increase as a result of the Terminal 2 project. The contribution from the treatment plant to the waterway in low flow conditions comprises up to 40% of total transport in relation to the waterway's target. Possible measures for a reduction from the treatment plant may be relevant, but will be independent of the Terminal 2 project.
The study further shows that the airport does not contribute phosphor to the Leira from Sogna, and that the effects of chemical input (glycol, formate and additives) are negligible for Leira.
On the part of Sogna, assessments of increased influence from deicing compounds have been carried out. The study has considered three scenarios. The scenarios comprise operation without the use of available infrastructure, operation with current infrastructure and normal influence from the airport. The assessments conclude that the operation of the airport with the current infrastructure will not have a negative effect on the Sogna. It is further worth noting that the water quality in the Sogna and Vikka currently is better than when the airport opened in 1998, mainly due to the following:

- Significantly less influence from deicing compounds due to better collection routines and facilities.
- Reduced load from runway deicing compounds due to transition to more eco-friendly products.
- Reduced load from scattered settlements.
- Reduced runoff from agricultural areas due to abandonment.
- Closure of the Gardermoen treatment plant (the Armed Forces' treatment plant with outlet to Vikka and Sogna).

In the “Sogna project”, which was carried out in cooperation with Nannestad and Ullensaker municipalities, it was established that nutrients, particularly phosphor, is the main source of pollution in the Sogna. The primary source of phosphor input is from areas outside of the airport area In the plan of action for Sogna, plans have been drawn up for improving water quality. In these plans it is assumed that OSL will establish a system that collects and treats surface water in the middle culvert in those periods where the concentration of deicing compounds is highest (“first flush”). The measure will be implemented before Terminal 2 is developed. The Terminal 2 project can therefore not be said to affect water quality in the Sogna river.

Erosion processes
The ravines to the south-west of the zoning area has been formed by natural erosion processes and constitute part of Øvre Romerike landscape conservation area. Before development of Oslo Airport in 1998, a precondition was that the ravine areas related to the Sogna and Vikka rivers were not to be affected. In order to document compliance with this, a report was prepared (Tuttle, 2001) where the erosion processes in the ravine areas were described and modelled for the reference state and for lower groundwater flux from east to west as a result of airport operations. It was concluded that changes in groundwater flux as a result of airport operations were within normal variations and that the ravine slopes are more stable at lower groundwater levels.

In connection with the Terminal 2 development it will be necessary to document that the solutions chosen for artificial infiltration ensure continued maintenance of the natural groundwater balance. If changes to the groundwater flux were to occur, it will be necessary to reassess how and to which degree this will affect the ravine processes. This should also be related to expected climate changes (DNMI, 2008) that entail increased precipitation volumes in shorter, more extreme sequences, which may also be significant for natural erosion.

Pothole lakes
The pothole lakes that lie east and north-east of the airport are downstream from the eastern parts of the airport. Some of the lakes are in direct contact with the groundwater such that influence form the airport area may cause changes to the lakes. Other lakes are not and have not been in contact with the groundwater.
In the detailed planning of Terminal 2, hereunder localization of infiltration plants, etc., it must be ensured that the groundwater level and flux does not lead to changes in the groundwater quality and the natural water balance of the pothole lakes.

For more detailed information on this work, refer to attachments 2 and 3:

- General plan for water management, Summary of sub-report. K-42145. OSL/COWI date June 2008.
- Impact assessment of the condition of the Sogna and Leira rivers as a result of Terminal 2. Undertaken by Aquateam – Norsk vannteknologisk senter AS. Date 25 September 2008.

3.3.3 Cultural environment – architecture and design

Even though the airport houses vastly differing functions with different requirements toward buildings and facilities, the airport currently emerges as a uniform facility, where aesthetic quality has been guiding for design. The design manual states the following: “The airport must appear as a modern high-tech facility which is also an example of sound Norwegian building traditions with extensive use of natural materials. Much emphasis is on adaptation to the environment and landscape, and that the entire facility has excellent aesthetic qualities. The design solutions must be simple, sober and close to nature, and provide both accessibility and well-being.”

It is assumed that the design manual's guidelines will also apply for the development of Terminal 2, and the following general guidelines were therefore stipulated for the planning competition:

- The new terminal shall become a domestic and international model project with future-oriented and innovative solutions for passengers, airlines and employees.
- The new terminal must be functional with good logistics solutions for passengers, employees and goods.
- The new terminal's design must have high architectural quality with uniform and good solutions in terms of environment, energy, use of materials and universal design.

The winning project/proposed solution is considered to have responded well to this.

The following description concerning the new central building is taken from the winning project:
“In the existing structure it is the central building with its large, embracing ceiling that is the dominant element, and the other components, the piers and railway station, are subordinate to this. This has been pursued in the proposed solution. The main ceiling of the central building is extended westwards. The ceiling of the northward pier root is intentionally low with a softly rising slope towards the pier such that the central building maintains its dominance and good lines of sight toward the sky are upheld. Pier B has been given a curved and almost tube-shaped enclosing ceiling and façade that indicates that heat is retained in the winter and the heat from the sun is kept out in the summer. Ideally one would have extended the main ceiling in its full depth on the north-south axis to emphasize the above. This has been thoroughly considered, in terms of both structural and operative conditions. The conclusion is the same that OSL itself has arrived at in the case of the eastward extension, that such a move is not practically or economically viable.”

Illustration that shows the central building, from the new part toward the existing part. Entrance to railway station at centre right.

“In the proposed linear extension of the central building, the same construction principles and axis widths as in the existing building are used. The provides a uniform exterior expression that emphasizes the building's distinct and simple architecture. Internally the new and existing check-in hall will emerge as a continuous space that will be flexible in terms of extent and location of the various airlines.
In the middle of the central building the railway station penetrates the space. Here the main ceiling is has a different structure to emphasize the station and also lets in more daylight than the rest of the main ceiling. The columns are relatively dense, slanted and seemingly random in a way that may create associations to a Norwegian birch forest.”

The following description concerns the new pier and pier root:
“The north pier root has a triangular shape the creates a gentle transition to the pier. The ceiling drops in curved shape toward the central building, which provides an open and good transition that bows to the central building's shape and volume while also providing light and a view of the sky from the central building.
A high and open triangular central space is created that provides visual contact with the pier for both international (level F) and domestic (level H). At the west there are galleries at level G, in addition to escalators and lifts for passengers, while to the east at the same level there is a possibility for future spaces for catering or other services.”

Illustration showing the perspective of the new pier viewed from the north-east.

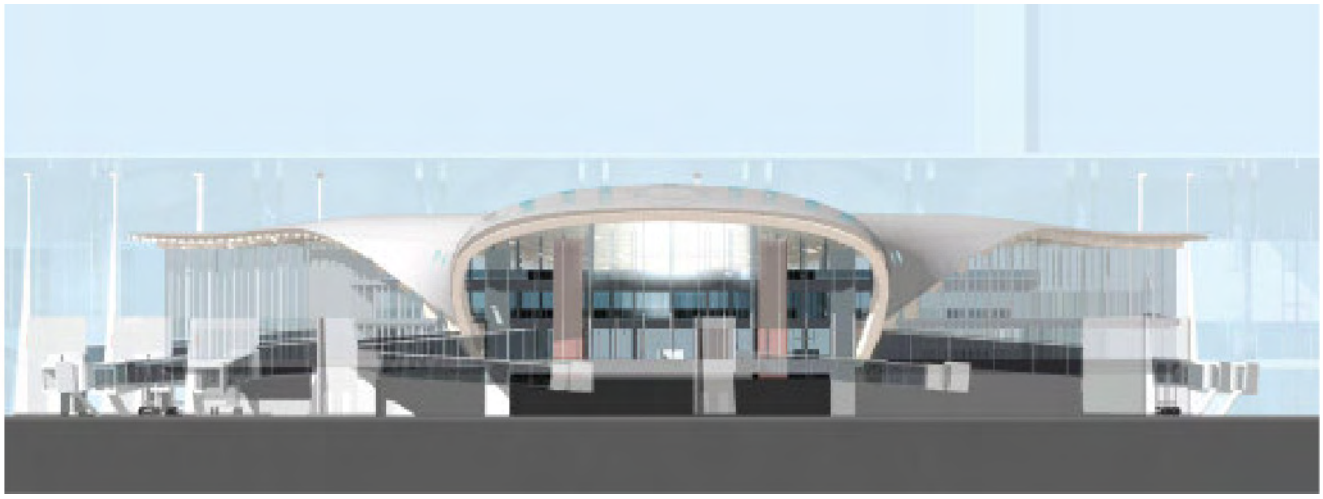


Illustration showing the shape of the roof and cross-section through the pier, from the north toward the pier root and central building.

3.4 Consequences for natural resources

3.4.1 Energy solutions

Introduction
OSL's overarching goal is to choose flexible energy solutions that enable the use of alternative energy sources. Such flexibility in energy supply allows one to choose the most environmentally friendly heating method at any given time. The existing buildings fulfil this requirement and it is presumed that this principle will be pursued in the development of Terminal 2. New requirements in the revised TEK and NS 3031 standards will be followed, and emphasis will be placed on describing solutions that ensure the choice of products with low energy requirements.
The project's goal is to achieve significantly lower energy consumption per square metre than the current terminal. It is presumed that the new buildings will be planned and built such that a significant proportion of the heating requirement can be covered by other energy supply forms than electricity and/or fossil fuels.

This early in the project phase the final solutions are still not clear, but the winning project focuses on the subject and has described issues and proposals for solutions that will be evaluated in more detail in the draft and preliminary phases.

Design strategy
Terminal 2 must be designed to appear as a model building in terms of energy use, energy supply and sustainability. The consulting group has described a strategy for integrated energy design based on a uniform perspective towards structures and technical facilities, and based on the Kyoto pyramid, where the initial focus is to satisfy regulatory requirements pursuant to TEK-07. The secondary focus is to minimize energy requirements. Measures that are cost-effective in terms of reducing the strain on the environment are emphasized.

The building must be at least as energy-efficient that it satisfies new building regulations. Heating and cooling requirements are calculated when the building's design, building materials, ventilation solutions and hours of operation have been determined. These are by far the most important factors for scaling heating and cooling facilities.

Thermal energy supply
OSL currently operates an eco-friendly energy plant with a groundwater-based heat pump facility as primary plant for both heating and cooling. The continued use of this plant for heating and cooling energy for the new terminal is assumed.

If calculations of heating and cooling requirements indicate a need to expand the existing district heating plant, it is natural to continue to use the ground for energy storage, as is the case with the current solution. Preliminary analyses indicate that there is a need to increase the effect and capacity in terms of cooling, but this will need closer consideration in the draft and pilot projects.

In case of expansion of the existing groundwater-based heat pump facility, emphasis must be on maintaining environmental considerations related to temperature and pollution of groundwater, and system solutions in compliance with regulations and permits for use of the ground for energy storage must be used.

To assess the ground conditions in connection with increased energy exchange, models will be established to monitor and simulate consequences in terms of temperature and environmental conditions with an aim to avoid unfortunate environmental effects on the ground.

3.4.2 Material extraction – raw materials for building

Status – applicable planning documents
The development of the main airport in the 1990s resulted in the extraction, relocation and disposal of large volumes and different types of loose material. Pollution authorities and Ullensaker municipality provided clear guidelines for where and how material could be used and which environmental considerations that had to be taken in the handling process. In order to ensure rational exploitation of material within the airport area and also satisfy environmental requirements, a material disposal plan was drawn up in the construction phase that included all major material extraction and disposal work. (Material disposal plan for for Oslo Hovedflyplass AS, dated 15 March 1996.)

This material disposal plan describes the terms for extraction and disposal, the type of materials, the individual extraction locations and the system for follow-up and continued updating of the plan. The extraction areas discussed are MG1, runway areas east/west, the access zone and operations area. The MG1 area, which covers an area of approx. 80 decares, is to the north-east of the airport area, between the eastern runway and the Gardemoen rail line, and was assumed to be used for both extraction and refilling of earth and sand materials.
In accordance with the material disposal plan, MG1 was to be refilled to its original volume and be concluded by 31 December 1998. The work has not been finalized for various reasons.

In August 2005 a survey was carried out of all material deposits and material extractions that currently were in use inside the airport area. Work was also started on preparing premise and procedure documents for regulating material deposits and material extractions. The intention of this work was that each individual development project at OSL should have dedicated material disposal plans.

Follow-up – measures
During the course of 2009 a new updated overview of all material deposits and material removal within OSL's area, with indications of volumes and descriptions of content. This will be plotted in OSL's maps for use in further planning. Steering documents will be drawn up that provide an overview of the permits that various activities require and how these are prepared and complied with. These steering documents will provide clear guidelines for how development projects and day-to-day operations at OSL relate to material disposal and material extraction inside the airport area.
In accordance with the aforementioned, a separate material disposal plan will also be drawn up for the Terminal 2 project. Such a plan is currently not possible to prepare, as it requires far more detailed planning of buildings and structures to calculate material extraction and requirements.
How this material disposal plan will be related to the project and handled by the municipality/authorities will be clarified later.

3.5 Consequences for society

3.5.1 Aircraft noise

Current situation
Noise zone mapping currently exists with an official noise zone map for the period 2002–2020, drawn up in accordance with the Ministry of the Environment's guideline T-1277 – Land use in aircraft noise zones. This forecast for traffic in 2020 employs a high forecast with 322,300 aircraft movements.

In 2005 the Ministry of the Environment introduced a new guideline, T-1442: Guideline for managing noise in land use planning. This guideline also includes guidelines for calculating aircraft noise. The guideline recommends that two noise zones are indicated around important noise sources, one yellow evaluation zone and one red restrictive zone. The zones are a signal to developers that noise must be considered in plans for new developments that are sensitive to noise (year-round residences, holiday homes, schools, day care centres, etc.) Noise limits for the different zones are indicated in the guidelines.

Mapping an aircraft noise zone pursuant to T-1442 must include a prognosis of the situation in 10–20 years time, as is also the case under T-1277. In order to be able to prepare this kind of forecast, it is essential that we know the content of the forthcoming regulations for approaches and departures at Oslo Airport Gardermoen. The Civil Aviation Authority's proposal for new regulations for approaches and departures is currently being processed by the Ministry of Transport and Communications. Several aspects of this proposal will change the noise situation around the airport. In connection with the Civil Aviation Authority's (LT) preparation of a proposal for new regulations, a noise impact assessment of the changes proposed in the new regulations was created, and OSL prepared noise zone charts pursuant to T-1277 for the years 2002 and 2020.

OSL does not consider it worthwhile preparing new aircraft noise charts pursuant to the new guidelines from the Ministry of the Environment, before a decision has been made regarding how air traffic is to be regulated in the future. However, in connection with this impact assessment for Terminal 2, new noise calculations have been performed pursuant to the Ministry of the Environment's new T-1442 guidelines, but these have been based on the Ministry of Transport and Communication's current noise regulations for OSL (AIP ENGM AD 2.21).
It is uncertain when and if the new regulations will come into force, and the new calculations, based on current noise regulations, are therefore not subject to updating of official noise zone maps for use in plans pursuant to the Planning and Building Act.

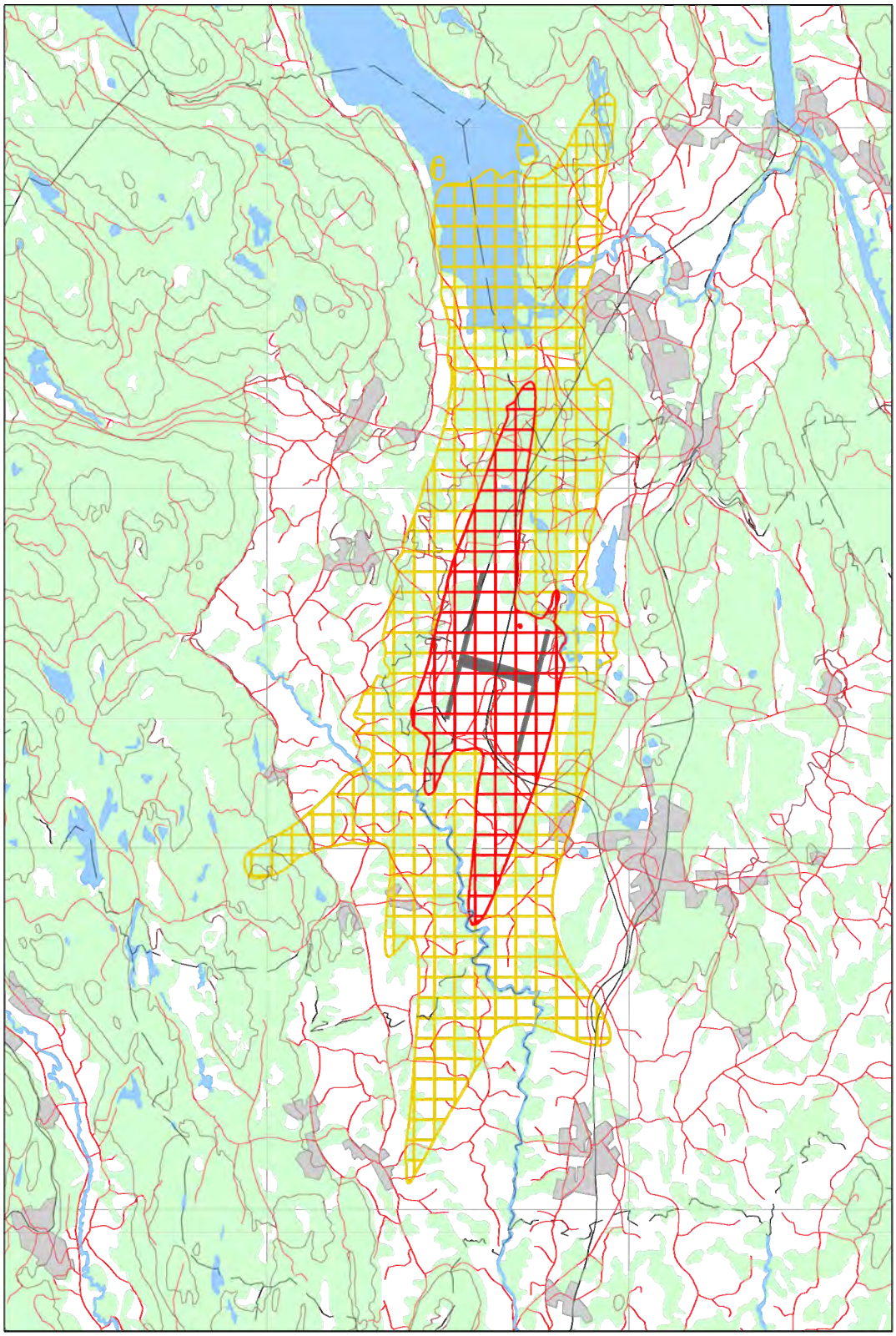
The noise load is shown as yellow and red noise zone for each calculation alternative.

The calculations use recorded traffic in 2007 as the basis, and updated forecasts for the years 2015, 2020 and 2025.

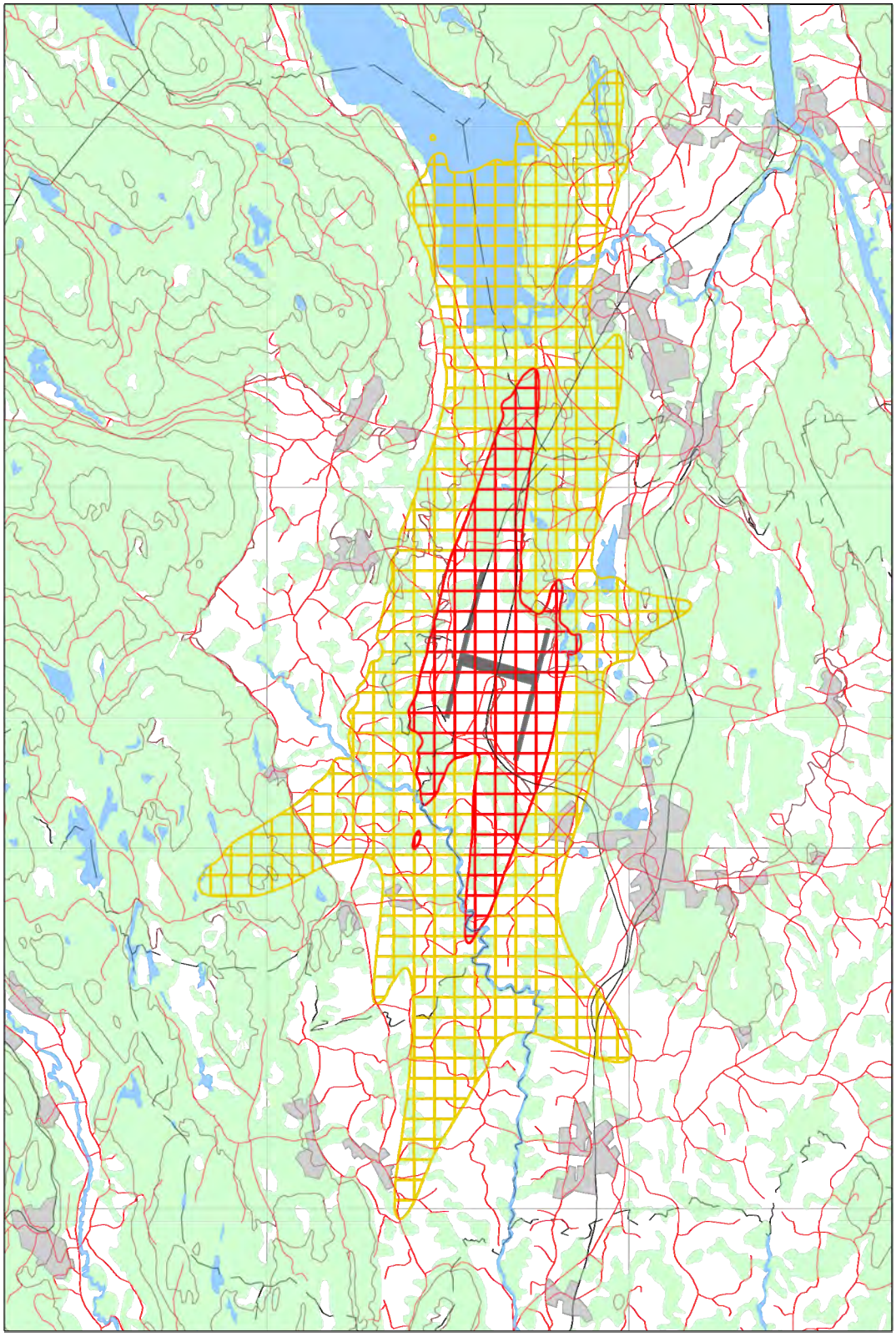
Year	2007	2015	2020	2025
Annual traffic	216,300	295,500	328,200	352,100

Noise zones for the relevant years are presented on the following pages.

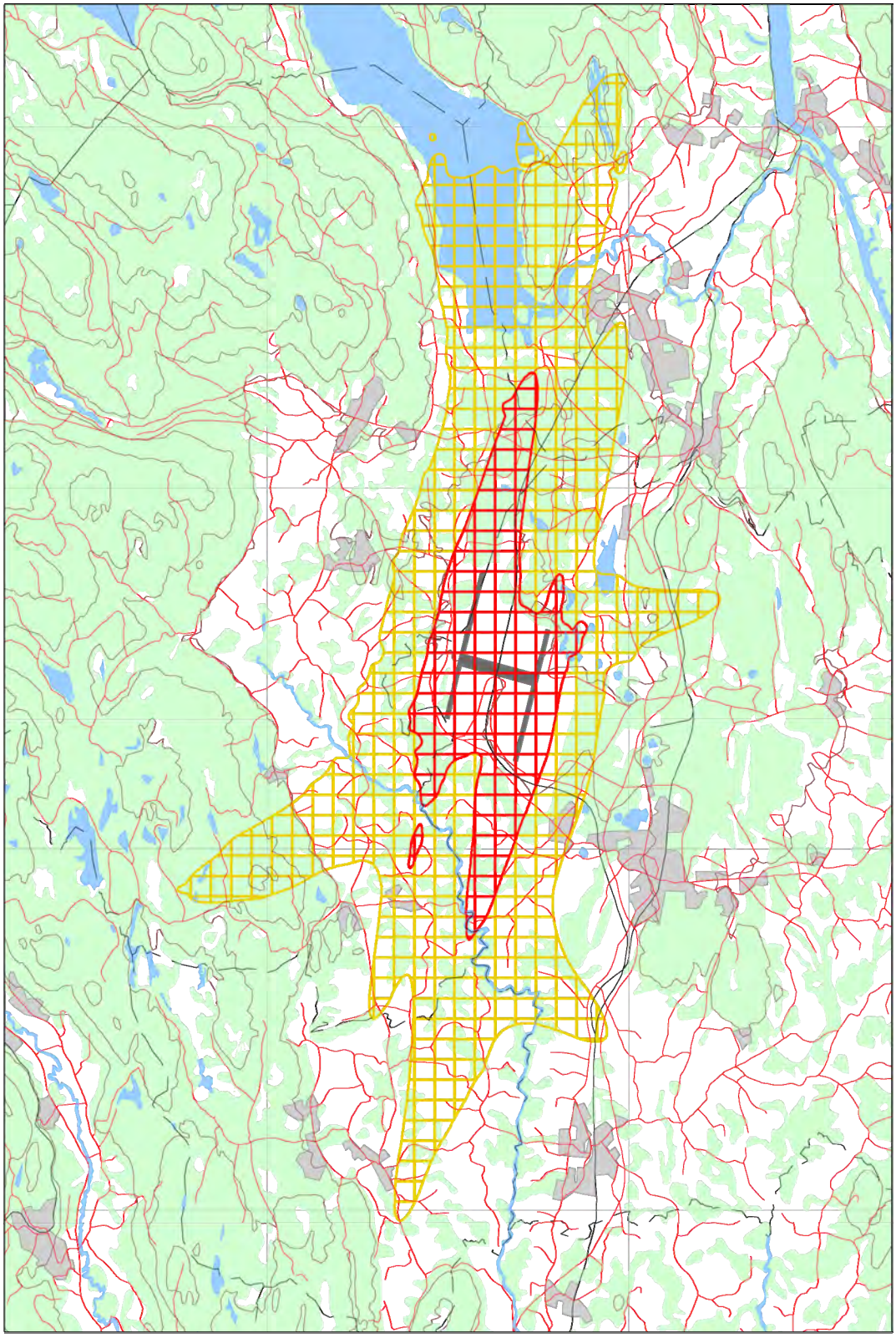
OSL continuously monitors noise conditions around the airport. An advanced noise and track monitoring system provides data for the regular monthly reports to the Civil Aviation Authority, the Ministry of Transport and Communications and the neighbouring municipalities. These are available on OSL's website.



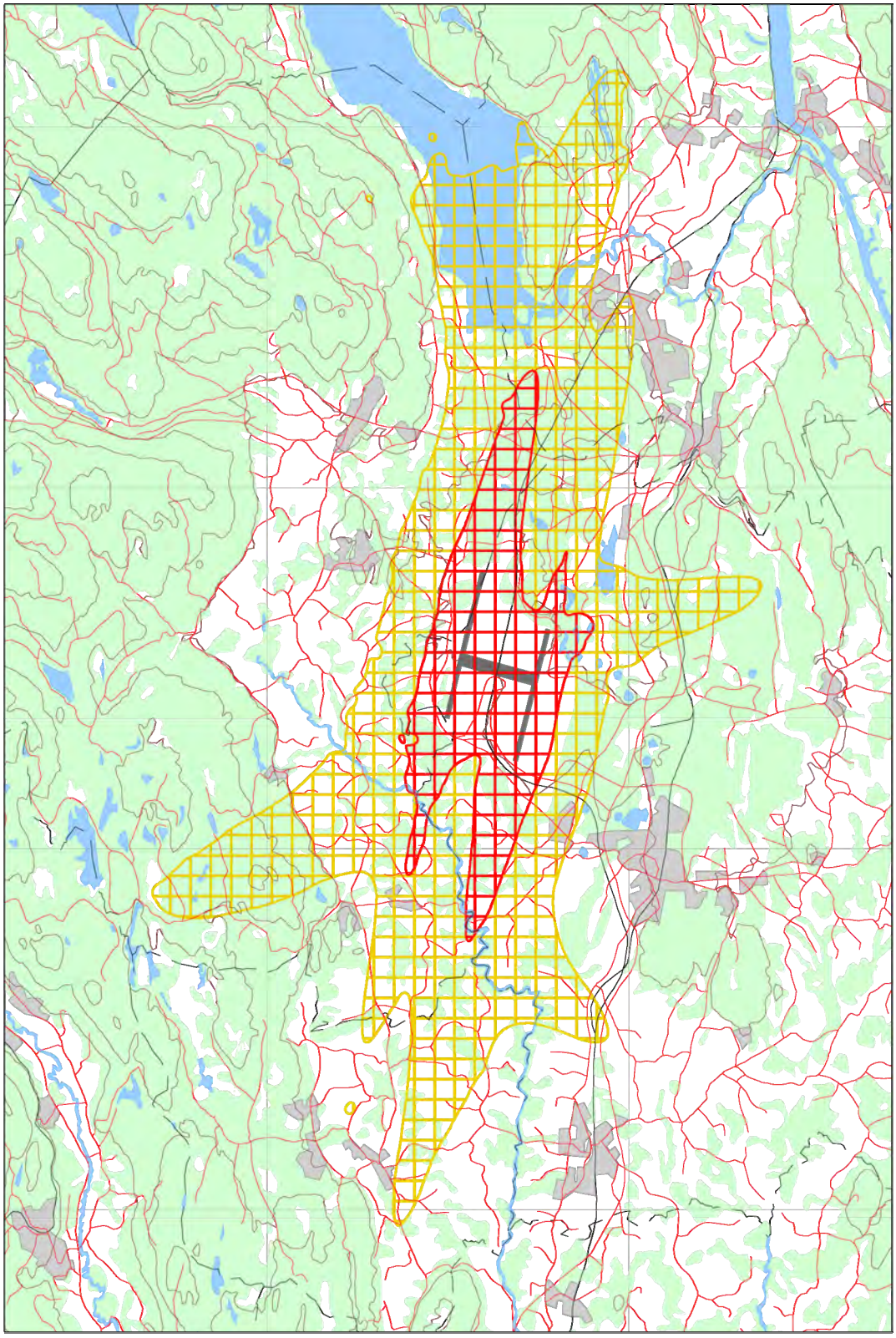
Noise zones for OSL, calculated in accordance with guideline T-1442 for 2007.



Noise zones OSL, calculated in accordance with guideline T-1442 for 2015.



Noise zones OSL, calculated in accordance with guideline T-1442 for 2020.



Noise zones OSL, calculated in accordance with guideline T-1442 for 2025.

Relevant issues – follow-up
OSL does currently not have further information on future air traffic. Terminal 2 will in itself not alter preconditions for traffic volumes and traffic distribution, and OSL does therefore not see the need to initiate a new round of noise charting in order to update the official noise zone chart before new regulations for approaches and departures are available.

In connection with the review of the study programme, the County Governor represented by the environmental protection department forwarded a contribution concerning aircraft noise, where they referred to the new regulation for approach and departure at Gardermoen where it is pointed out that runway use is of great significance for the distribution of the aircraft noise zones. The County Governor pointed out that there was a need to assess whether the design of Terminal 2 and choice of layout for the new pier would have consequences for the approach and departure pattern, hereunder choice of runway and any consequences for ground noise and use of the deicing platforms. They did not request calculations of aircraft noise zones, but clarification of whether this will affect runway use.

The development of Terminal 2, including the location of the new terminal and pier in connection with the existing terminal building, is not considered to have consequences for the approach and departure pattern, runway use or use of the de-icing platforms. This also applies if the taxiing pattern is changed, in that the current taxiway is moved northwards due to the new pier.

New noise regulations are expected to cause changes to traffic patterns. The new regulations will impose requirements towards precision in departures (tolerance corridors), and flexible runway use. Use of runway direction is largely dependent on wind conditions and cannot be influenced.
The Civil Aviation Authority states the following in its summary of the consultation comments to the new regulations:
“Based on completed noise measurements, test flights, etc., we believe the proposal allows for the reduction of noise as far as possible within safety constraints, and that in sum the noise conditions for those living close to and around Gardermoen will improve”.

Further evaluations of the future noise situation must be awaited until new regulations for approaches and departures are available.

3.5.2 Feeder traffic – transport network

Background
According to the approved study programme, the impact assessment must include the themes:

- Feeder traffic/transport network
- Parking – public transport, and
- Consequences of the building and construction activities:

This assessment includes the above themes. The assessment has been carried out based on the approved study programme, and provides OSL and the affected municipalities and other authorities important input in the field of transport for the years ahead in terms of strategies for own activities, hereunder scenarios/development trends and forecasts that can be of use in contact between municipalities, the Public Roads Administration, the National Rail Administration, train and bus transport companies, in addition to developers and other relevant bodies.

Content – important preconditions
The assessment initially deals with the entire transport system for feeder traffic to OSL, but will discuss the Oslo axis somewhat briefly as this is dealt with in particular in TØI's working document "OSL Terminal 2 – Parking and public transport share" (cf. attachment).
Particular emphasis has been placed on discussion and assessments of requirements and capacity in terms of public transport as well as the road aspect. Further, focus is on development scenarios for the east-west axis, with primary focus on the Jessheim-Gardermoen area.
The pedestrian and bicycle path system to the airport has not been given special consideration in the study. It is nevertheless very important that this system as well, particularly toward Jessheim and Nannestad, is developed and operated in order to provide safe access for everyone who would prefer to use such a facility. With respect to the total volume of feeder traffic to/from the airport, the scope of pedestrian and bicycle traffic will however be of less significance.

The time perspective of the assessments have been defined with reference to the two development phases for Terminal 2, as they were originally indicated in the study programme; phase 1 with completion in 2012 and phase 2 with completed development in 2025. Traffic has increased significantly faster than the original forecasts indicated, such that capacity for the completed development could be reached significantly earlier, perhaps as soon as 2020. Based on this, the study has used the years 2012 and 2025 as relevant key years for preparing statistics, in addition to a trend projection to the year 2040. It has subsequently been decided that phase 1 will be completed somewhat later than 2012, but this is not incorporated in this assessment, and it is not considered to be of significance for the conclusions.

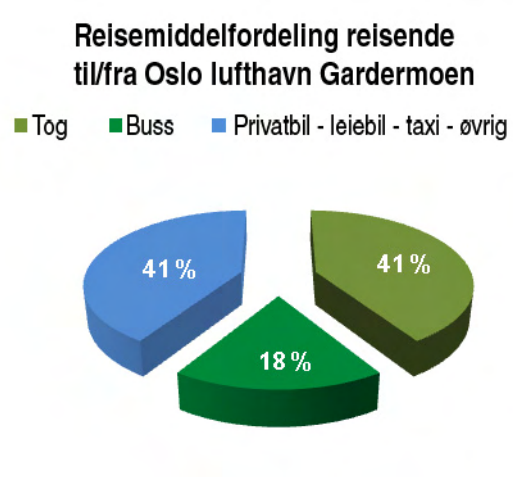
The total number of passengers to/from OSL includes transfer passengers who only use the airport/terminal between two trips, and passengers who start or terminate their trips at OSL. This study primarily deals with this latter group of air passengers, in addition to all employees and visitors that also use and exploit the land transport service to/from the airport. The number who walk or cycle to the airport are, as previously mentioned, negligible and are not included in the tables. In these tables the use of taxis is defined as car traffic, i.e. not as public transport. This is in keeping with the Institute of Transport Economics' definition.

The forecasts for future traffic loads by car compared to public transport to/from the airport are based on forecasts for the development in air passenger figures and employee figures related to air traffic handling. Further, it deals with developments in traffic distributions up to the present as well as assessments of capacity and travel times for car and bus, as well as rail-based means of public transport toward the forecast dates. The use of eventual restrictive measures to influence traffic distribution, e.g. parking restrictions, have not been specifically considered.
A target of a public transport share of 65%, which is indicated as a possible target in certain governing documents, has not been used as a guideline in the report's scenario descriptions, but the report's assessments indicate that such a target may as well be probable, based on what currently exists in terms of plans for developing the transport service.

In the discussion of the future transport service for cars and public transport, including parking, the assessment pursues the municipality's clarification that this must be viewed in a long term perspective. As previously mentioned, the forecasts apply to 2025 and 2040. There is also a desire for an overarching, combined overview of the parking facilities..
The assessment further complies with the municipality's decision, where it emerges that the possibility for better local feeder transport between Jessheim and the airport must be studied, and where a rail solution may be relevant.
Finally, the study deals with the municipality's request that for the construction period there should be a careful assessment of works traffic and environmental effects, and a description of measures on the main and local road network. This is described in chap. 36

Current traffic and transport system
The traffic increase at OSL has been significantly higher than earlier forecasts indicated, and the assumed capacity limit has already been reached in terms of the terminal's capacity for air passengers. The total number of passengers increased from 11.7 million in 1998 to 19.3 million in 2008. Of this total of slightly less than 20 million, it has been calculated that approx. 14.2 million passengers, or roughly 39,000 on average per day, use the road and public transport system to and from the airport. In addition there are the employees, visitors, goods deliveries and freight transport to the airport, etc.

TØI's report reveals that a huge 87% of passengers come from the south, primarily from the Oslo area. The combined total for passengers from all directions is a public transport share of just below 60%, whereof 41% use the train (Airport Express Train 34% – NSB 7%) and 18% use the bus. See figure.



Transport distribution between train, bus and car 2008 (TØI 2008)

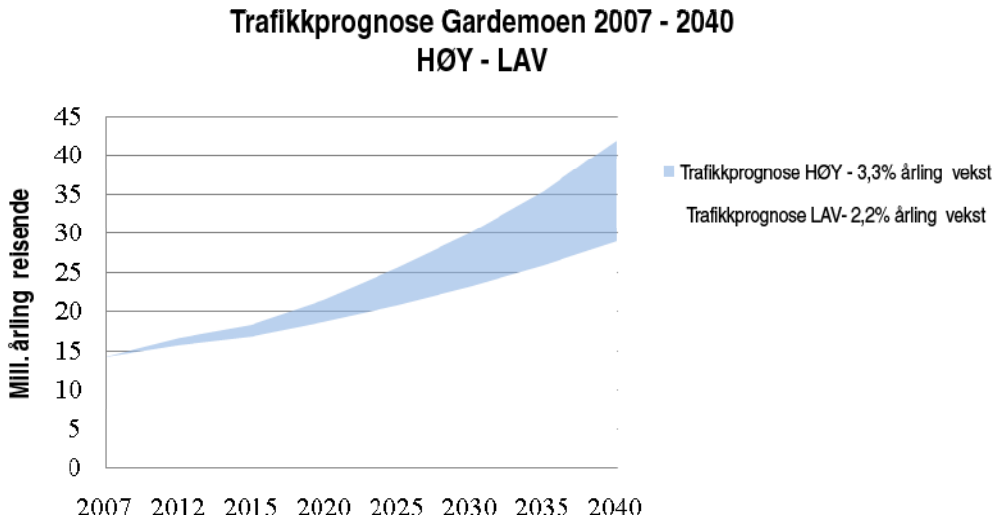
Out of the combined car traffic to/from OSL, figures from 2007 show that 60% is generated by air passengers while 32% is employee traffic and 8% is visiting traffic.

The public transport service is significantly better toward the south than toward other directions from the airport due to the Airport Express Train and NSB's comprehensive and frequent departures. Trains and buses provide approx. 10 departures every hour in each direction between Gardermoen and Oslo. The service is poorest toward west and east, where bus traffic has difficulties competing with car traffic. The public transport service in the “Jessheim city” is primarily based on local use of regional bus routes that go in all directions from Jessheim. Even though the scheduled service may not be perceived as poor, the route network and frequency is not good enough to attract larger shares of local passengers to the airport.

The capacity of the road network in the airport's vicinity has increased somewhat since the opening in 1998, particularly along the east-west axis. The new national road 120 was completed in 2002, new national road 35 over Nannestadåsen to Hadeland in 2003, new national road 454 outside of Jessheim

centre in 2006 and extended national road 460 Balders veg to Gardermovegen in 2007. Up until now there has been adequate reserve capacity in the “old” road network.

Background for future traffic developments
Forecasts for developments in the number of air passengers to/from OSL from 2007 (TØI 2008) indicate an annual growth of between 2.2% (LOW) and 3.3% (HIGH) per year. Disregarding transfer passengers this entails that the number of air passengers using the feeder system to/from OSL will increase from 14.2 million passengers in 2007 (averaging approx. 39,000 a day) to between 20 and 25 million in 2025 and then to between 29 and 42 million in 2040 for the LOW and HIGH forecasts respectively. In other words, we can expect an increase of between 40 and 80 % up to 2025, and an increase of between 100 and 200% up to 2040. Cf. below figure.



HIGH and LOW traffic forecast for air passengers to/from OSL/Gardermoen 2007 – 2040 (excl. transit/transfer passengers)

The employees comprise the second largest group of travellers to/from the airport. In 2007 there were approx. 13,000 employees connected to traffic and operations at OSL. With reference to various documents on developments, it is estimated that the number of employees at OSL may increase from approx. 13,000 in 2007 to between 17,700–21,700 in 2025 and further to between 23,500–33,700 in 2040 for the LOW and HIGH forecasts respectively.

Settlement patterns for employees have changed significantly since the airport opened in 1998. It is expected that these changes will continue in the time ahead so that the municipalities in Øvre Romerike will increase their share of employees from 32% in 2007 to 42% in 2040. The municipalities in Nedre Romerike increase their share from 8% to 10%, while Oslo and Asker/Bærum reduce their share from 33% to 27%. Among other things, this means that the number of employees living in Ullensaker may increase from approx. 2,000 in 2007 to between 4,700 and 6,700 in 2040.
A number of overarching public reports have dealt with developments at Gardermoen, and have also provided/proposed a number of guidelines and recommendations for how developments should be governed and facilitated. The documents all identify somewhat very specific measures for adaptation of the public transport system in particular, with a view to improve its attraction and achieve higher traffic shares.

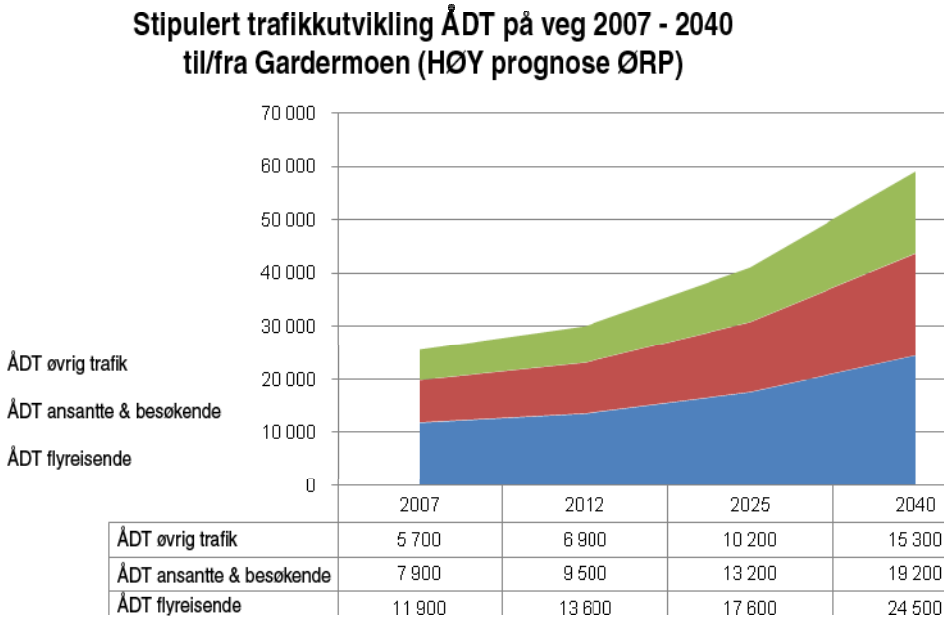
Road traffic and road network
Road traffic will increase significantly in the years ahead if the forecasts for increased air traffic are correct. The table below shows somewhat different forecast figures based on Cowi's traffic analysis and forecast for developments in the Jessheim – Gardermoen area, ØRP's own forecasts based on TØI's forecasts for HIGH and LOW groeth in air traffic. Cowi's figures are somewhat higher than the figures from ØRP. Currently it is difficult to be sure of which figures will apply, but alternatively the differences may rather be understood as merely a question of when the forecast traffic figures will

occur. The absolute requirement toward road capacity and number of lanes thus varies little in a long-term perspective.

	Average annual daily traffic (AADT)			
	2007	**2012**	**2025**	**2040**
Cowi's traffic analysis	25,500		46,000	
HIGH forecast ØRP.	25,500	30,000	41,000	59,000
LOW forecast ØRP	25,500	28,200	37,400	52,100

Comparison of COWI's and ØRP's forecasts for average annual daily traffic in and out of the terminal area in 2012, 2025 og 2040.

Passengers arriving in their own cars or who are dropped off constitute 45% of car traffic to the airport. See figure/table below (figures apply to HIGH forecast from ØRP)



	2007	2012	2025	2040
ÅDT øvrig trafik	5 700	6 900	10 200	15 300
ÅDT ansantte & besøkende	7 900	9 500	13 200	19 200
ÅDT flyreisende	11 900	13 600	17 600	24 500

Stipulated development in average annual daily traffic (AADT) for air passengers, employees, visitors and other traffic for the period 2007 – 2040 (HIGH forecast ØRP)

The current road traffic distribution to the airport area shows that a huge 80% of road traffic is generated south of the airport, 8% to/from the north, 9% to/from the east and only 3% to/from the west. See table on next page. Local traffic in Ullensaker to/from the airport currently constitutes approx. 7.5%, whereof most is included in the traffic figures from the east.

Road traffic forecasts in the case of HIGH growth in air passenger figures at OSL Gardermoen 2007 – 2040

Direction to/from	AADT vehicles/day			
	2007	2012	2025	2040
From North: 8 %	2,000	2,300	3,300	4,800
From South: 80 %	20,400	24,000	32,500	46,800
From East: 9 %	2,200	2,700	3,900	5,500
From West: 3 %	900	1,000	1,300	1,900
Total all directions	**25,500**	**30,000**	**41,000**	**59,000**

Stipulated development in airport-dependent annual average daily traffic (AADT) to/from airport area 2007 – 2040, distributed between directions in case of HIGH forecast ØRP

Traffic to/from OSL constitutes a large share of traffic on the road network in close proximity to the airport, but drops fast as the distance from the airport increases. While the share constitutes around 90% on national road 35 just east of the terminal, the share drops to around 50% on the E6 just south of Jessheim.
On the E6 northwards the share is only approx. 10% ref. table below. The share on the E6 towards Oslo drops further the closer one gets to Oslo. According to TØI's report, the share in the afternoon rush hour is currently only approx. 13% at Skedsmovollen and approx. 7% at Furuseth. Forecasts indicate that the share may double in 2040, but it will remain modest compared to other traffic.

Road link	TØI Report		2012		2025		2040	
	to/from airport	Total Cowi 1)	to/from airport		to/from airport	Total Cowi 1)	to/from airport	
Rv 35:								
west of airport	900	9,800	1,000		1,300	13,500	1,900	
east of airport	24,600	25,900	28,900		39,500	41,400	57,100	
E6:								
north of Ullensaker	2,000	22,600	2,300		3,300	27,400	4,800	
north of Rv 35	2,100	19,500	2,400		3,500	34,900	5,000	
south of Rv 35	20,500	37,600	24,100		32,600	63,900	46,900	
south of Jessheim	20,000	43,600	23,500		32,000	61,100	46,000	

1) from traffic analysis forecast 2008 - 2025 (COWI 2008)

Traffic load on primary road network. Figures represent HIGH forecast for airport traffic

Capacity problems on those parts of the road network with traffic to/from OSL will primarily be on the E6 southwards from the national road 35 intersection. The current planning programme for development of the primary road network (National Transport Plan) indicates few new measures toward 2019, beyond the work that is currently under way in building four lanes northwards from Jessheim and four lanes from Kløfta towards Kongsvinger. This entails that road capacity will be adequate towards the west (national road 35), towards the north (E6) and towards the east (national road 174+ national road 2) for regional transport for many years to come. Towards the south an undeveloped road network will not be capable of handling the traffic volumes on the E6 that are estimated in 2030 and 2040. The need for an expansion from four to six lanes may become somewhat urgent from 2020 and on. This may entail an increase in travel time by car from Oslo of around 10 minutes until 2025 (TØI 2007).

The road network in the Jessheim area may in the longer term experience significant traffic problems if measures are not implemented to increase capacity. The need is not specifically the increase in car traffic between the airport and Jessheim, but growth in housing developments and associated services,

as well as the strong growth in jobs that is expected in Gardermoen Industrial Estate. This will partly be the result of the normal growth of the urban area, partly as spin-off effects of the growth at the airport.

The development of the road network in the Jessheim area is primarily the responsibility of the municipality and the Norwegian Public Roads Administration, but it is important that this is also functionally designed in relation to the airport. A draft for future development of the road network is presented in the next page. The draft allows for a primary road network based on national road 35 and the E6, and an airport and industry-related road network that links to these roads, such that traffic to/from these areas does not use the local road network for housing areas and service areas in the future Jessheim city. Emphasis has been on developing a flexible system for feeder roads in the industrial estate, with good connections directly to the airport. In relation to OSL/Gardermoen emphasis should be on developing this such that it may also act as a ring road system that ensures reasonable accessibility to the airport even if e.g. national road 35 should become blocked for any reason.

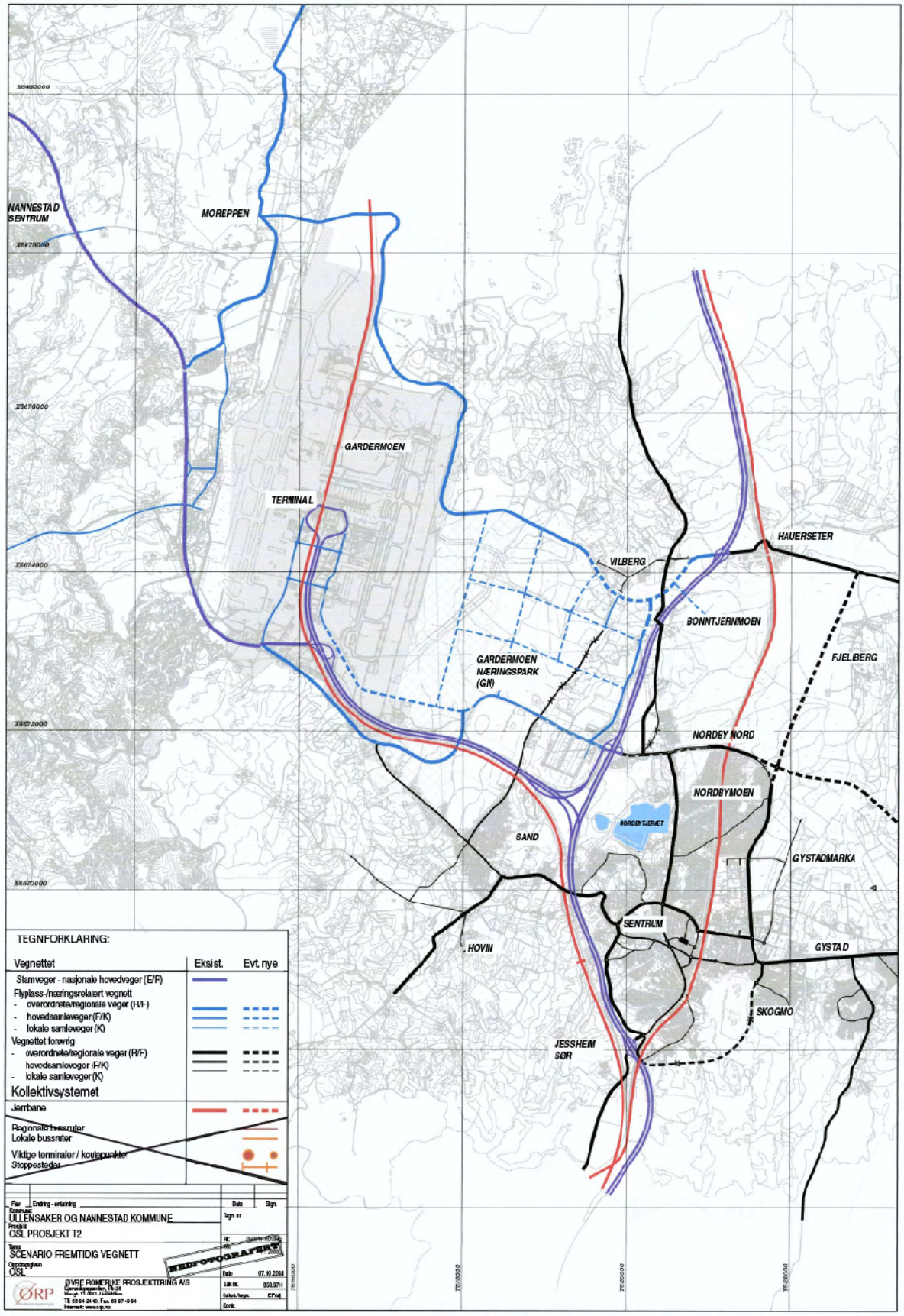
In terms of the need for new road systems in the Jessheim area, the following systems are considered particularly relevant for development in the period up to 2025:

<u>Increased capacity Jessheim north</u>

- expansion of the intersection area E6/Jessheim north with adjacent roads
- expansion of sections on Industrivegen and Algarheimsvegen (national road 174) or development of new national road 174 towards Algarheim from E6 north
- expansion and new development of feeder road system in Gardermoen Industrial Estate to the E6 (expansion required in time with growth of industrial estate).

<u>Capacity Jessheim centre and Jessheim south:</u>

- new bisecting road under the railway from the centre to national road 174 Industrivegen
- refurbishing of Ringvegen
- traffic regulation and rationalization of the road network in the centre
- expansion of the intersection area E6/Jessheim south
- new detour route Jessheim south-east.



3.5.3 Public transport – public transport shares and parking facilities

Public transport services and public transport shares
Oslo Airport Gardermoen has the highest share of public transport of all European airports and is number five in the world, according to a British survey from 2007. At the time of the survey, the public transport share was 60.1%, while the average for all of the 57 airports in the survey was only 25.5%. Almost all governing documents concerning future transport strategies, hereunder the transport plan for Øvre Romerike and the municipal plan for Ullensaker, recommend that in the future one must focus efforts on increased use of public transport and increased public transport shares, not only for passengers to/from OSL, but for society as a whole.
With respect to the high share of public transport already enjoyed by OSL, it is natural to imagine that it would be difficult to achieve further increases, however, conditions appear to be very favourable for this to happen without other measures than those already planned. This particularly applies to the axis towards Oslo where significant standard and capacity improvements of the train service in particular are planned. The effects are strengthened by the fact that road travel times must be expected to rise and reduced competitive ability in that no increase of the road capacity is planned to keep up with traffic growth, at least not for the next 15–20 years.

For the other directions, toward the west, north, east and the local Gardermoen – Jessheim area, it is far more difficult to predict opportunities for increased public transport shares. The public transport service has limited competitive ability compared to car traffic, and efforts must be very focused to significantly increase public transport shares. It will be very important that all bodies/organizations that can affect the transport area view this as their joint responsibility and establish a common, agreed strategy for future public transport.
In total, assessments in the study indicate that the public transport share for both air passengers, employees and visitors may be expected to increase in the years ahead based on expected developments in public transport and in the road system.

Railway and bus
A number of measures are planned for rail, both in terms of the rail network and train services. This is expected to significantly increase capacity, quality and attraction. Much may already be in place from 2012. The Airport Express Train and local trains on the Oslo – Gardermoen/Jessheim line will provide more than double the current capacity, if plans are carried out as presumed. Services toward the north will also improve, albeit more modestly. In the longer term the establishment of dual tracks to Hamar will provide significant improvements in quality and competitive ability, but here the development of a new four-lane motorway will reduce some of the competitive ability in relative terms. The bus companies are also planning improved regional services, but it is difficult to achieve competitive advantages as long as the buses have to compete with cars on well-developed high-capacity roads to the north (four lanes on the E6), west (two lanes on national road 35) and east (four lanes on national road 2).

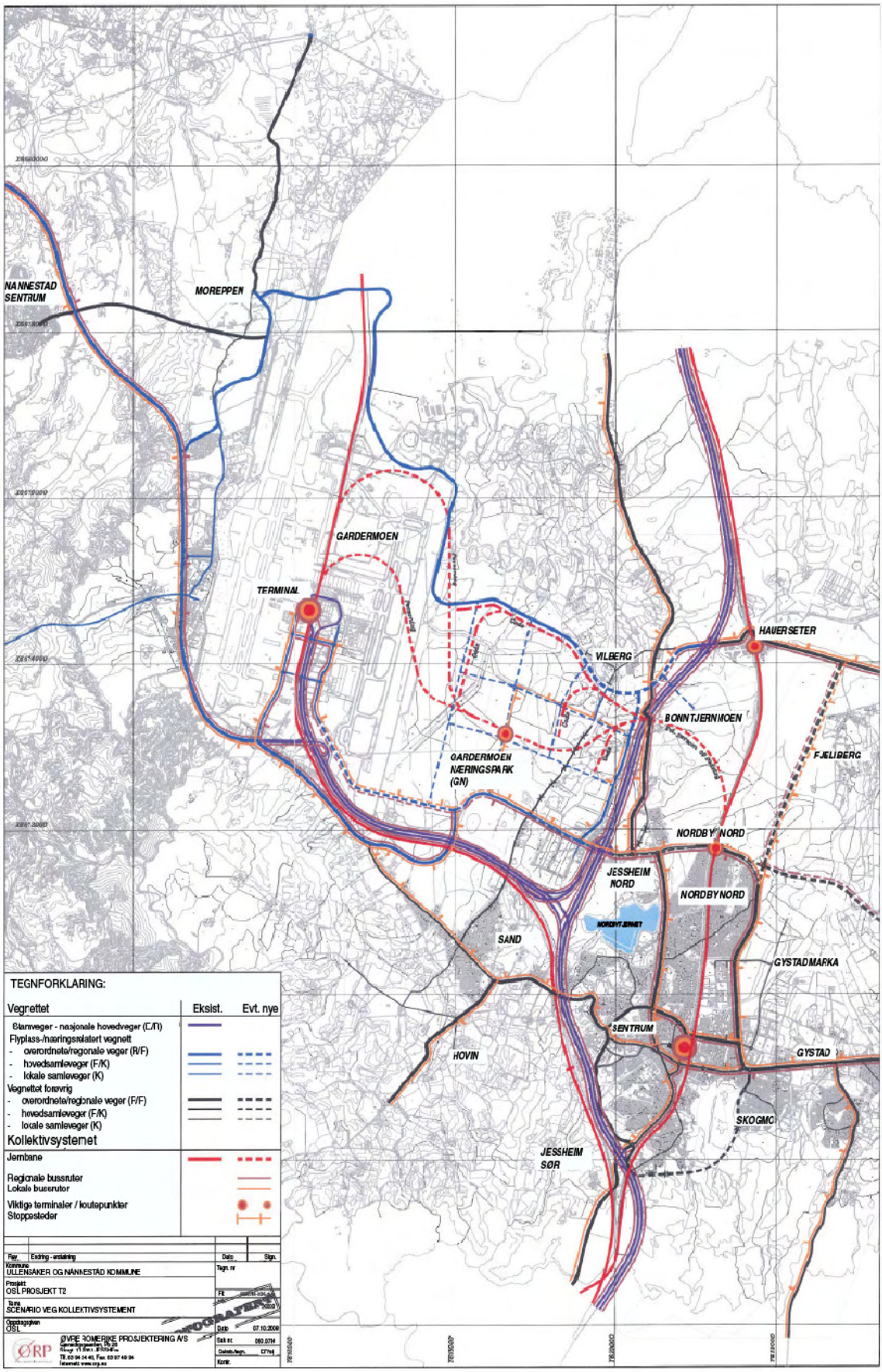
The preconditions for increased public transport shares will ordinarily and primarily depend on improved travel time relationships between public transport and cars. For public transport this primarily entails shorter travel time, higher frequency and better regularity, but comfort and price are also significant. On the part of roads, reduced travel speed/increased travel time will have the same effect. The use of parking restrictions at Gardermoen may also increase the public transport share, but such measures may be unreasonable for passengers who lack access to appropriate public transport services. A review of the transport service plans indicate that the possibility of increased public transport shares exist, particularly for rail transport toward Nedre Romerike and Oslo with connections on to Østfold and Vestfold/Buskerud. NSB's and the Airport Express Train's plans for increased frequencies and capacity provide, along with increased travel time for cars, an obvious basis for increased public transport shares in this corridor.

The bus companies are indicating increased regional services to the west, north and east, but as already mentioned, it is difficult to predict changes to public transport shares.

As a stage in the current municipal planning for Ullensaker, there is much commitment to facilitate development of public transport in the Jessheim – Gardermoen area in particular. A better bus service with express buses on the Jessheim - Gardermoen Industrial Estate - OSL axis would be a natural core of the system, but the possibility of establishing rail solutions in the longer term are also being considered.

A circle line solution that connects the main railway (between Oslo and Eidsvoll) and the centre of Jessheim with Gardermoen Industrial Estate and the airport is a possibility, and a route for this is also indicated in the municipal plan's land use section. Such a rail solution could provide a somewhat higher public transport share from Jessheim to the airport, but it is difficult to justify the solution based only on this traffic. The rail solution will first and foremost provide better opportunities for increased public transport from Oslo and Nedre Romerike to Gardermoen Industrial Estate. This may have great significance for traffic to/from the industrial estate, which in time may have almost as many jobs as the airport (20- 30,000). A purely local rail solution between Jessheim and Gardermoen with frequent stops has also been considered, but does not appear to provide the same opportunities.

A draft for long-term development of the public transport system in the Jessheim-Gardermoen area is shown on the next page. The main trunk in the public transport network is Hovedbanen and Gardermobanen (solid red lines). A ring line is indicated by a dotted red line from Hovedbanen to Gardermobanen with a stop in Gardermoen Industrial Estate. Two examples for connection to Gardermobanen are indicated. A further stop for for park-and-ride and transfer to local and regional bus routes is shown at Nordby north. In Gardermoen Industrial Estate possible lines for side tracks for eventual future goods transport by railway into the industrial estate are also indicated. The main line partly follows the old railway line along Blikkvegen. The main routes for regional and local buses are illustrated by brown and orange lines in the draft.
The drafts for a rail solution are preliminary. They have not been studied in detail and nor have they been presented to OSL and National Rail Administration for closer consideration.


NANNESTAD SENTRUM
MOREPPEN
GARDERMOEN
TERMINAL
VILBERG
HAUERSETER
BONNTJERNMOEN
GARDERMOEN NÆRINGSPARK (GN)
FJELIBERG
NORDBY NORD
JESSHEIM NORD
NORDBY NORD
SAND
GYSTADMARKA
SENTRUM
HOVIN
GYSTAD
SKOGMO
JESSHEIM SØR
TEGNFORKLARING:
Vegrettet
Eksist.
Evt. nye
Stamveger - nasjonale hovedveger (E/T1)
Flyplass-/næringsrelatert vegnett
- overordnete/regionale veger (R/F)
- hovedsamleveger (F/K)
- lokale samleveger (K)
Vegnettet forøvrig
- overordnete/regionale veger (F/F)
- hovedsamleveger (F/K)
- lokale samleveger (K)
Kollektivsystemet
Jernbane
Regionale bussruter
Lokale bussruter
Viktige terminaler / knutepunkter
Stoppesteder
Rev
Endring - omtalering
Dato
Sign.
Kommune
ULLENSAKER OG NANNESTAD KOMMUNE
Prosjekt
OSL PROSJEKT T2
Tema
SCENARIO VEG KOLLEKTIVSYSTEMENT
Oppdragsgiver
OSL
ØRP
ØVRE ROMERIKE PROSJEKTERING A/S
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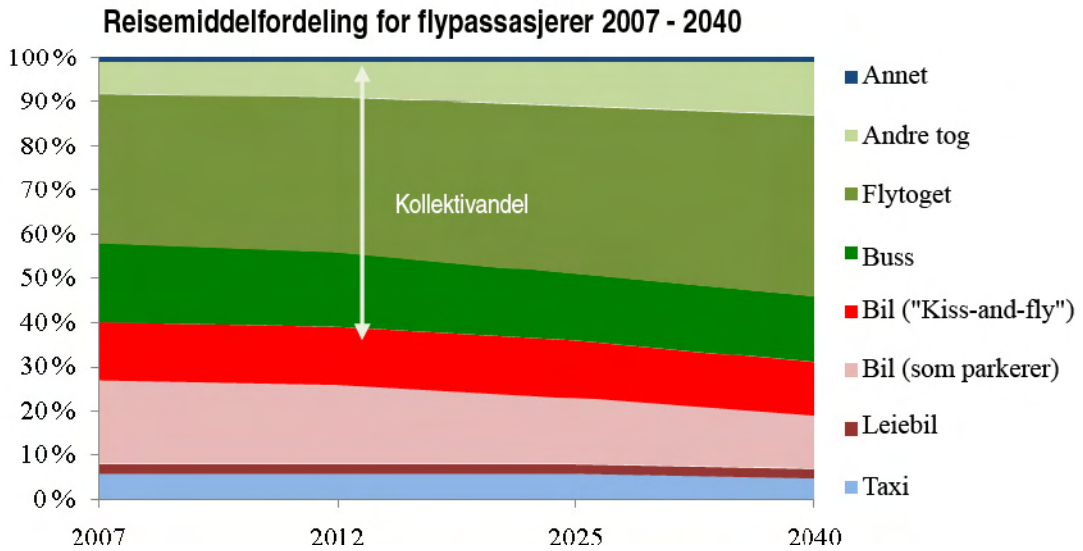
Future traffic distribution between public transport and other modes of transport for air passengers is stipulated in the below figure. The distribution is based on a trend projection of TØI's forecasts supplemented with further assessments of competition between car and public transport. According to this, the public transport share may be expected to gradually increase from 59% in 2007 to 68% in 2040. A public transport share of 65% may be achieved around 2030.



Stipulated development in distribution of modes of transport for air passengers 2007 – 2040. Source: TØI / ØRP

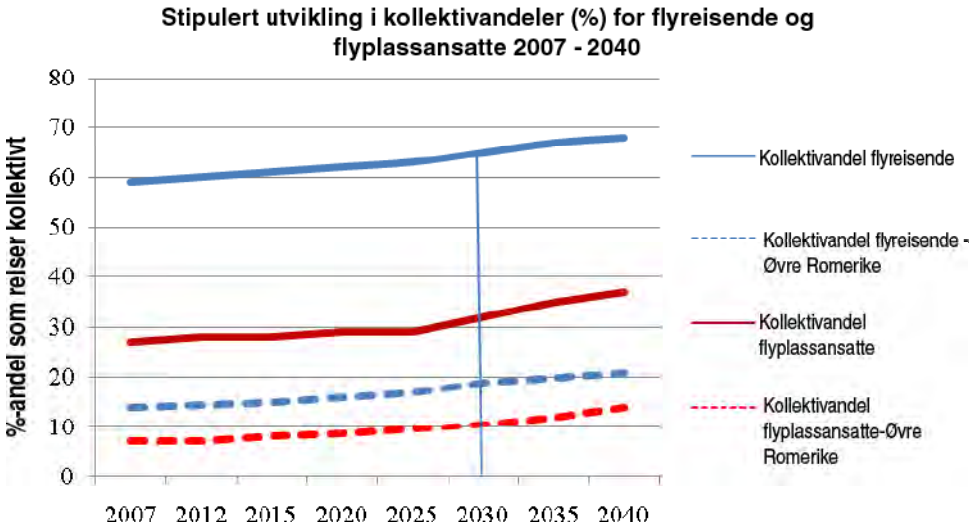
Stipulated developments in public transport shares for air passengers toward Oslo and in Øvre Romerike are shown in the table below. The table shows that the public transport share from the Oslo area is very high already, and that it may reach 70% around 2025. Øvre Romerike is significantly lower than the average. Passengers in this area must be offered significant improvements in public transport where the frequency and travel time must be perceived as a good alternative to the car if one is to hope for a significantly improved share on public transport.

Area	**2007**	**2012**	**2025**	**2040**
Oslo	65%	68 %	70%	71%
Asker and Bærum	60%	65 %	67%	68%
Nedre Romerike	39%	41 %	45%	50%
Øvre Romerike	14%	14%	17%	21%
TOTAL to/from Gardermoen	**59%**	**60%**	**63%**	**68%**

Stipulated development in public transport shares for air passengers between OSL and some destinations 2007 – 2040.

Employee public transport share

For airport employees too the share of those using public transport is expected to increase in the years ahead, even though the point of departure is significantly lower than that of passengers (approx. 28%), see figure on next page. The share is stipulated to increase from approx. 28% in 2007 to approx. 37% in 2040. The low share is of course related to the fact that a very high proportion of airport employees work shifts that are incompatible with the public transport services, while at the same time more and more employees are taking up residence in Øvre Romerike where the service is poorer than where they previously lived.



Stipulated development in public transport shares for air passengers and airport employees 2007 – 2040.

Parking capacity and service

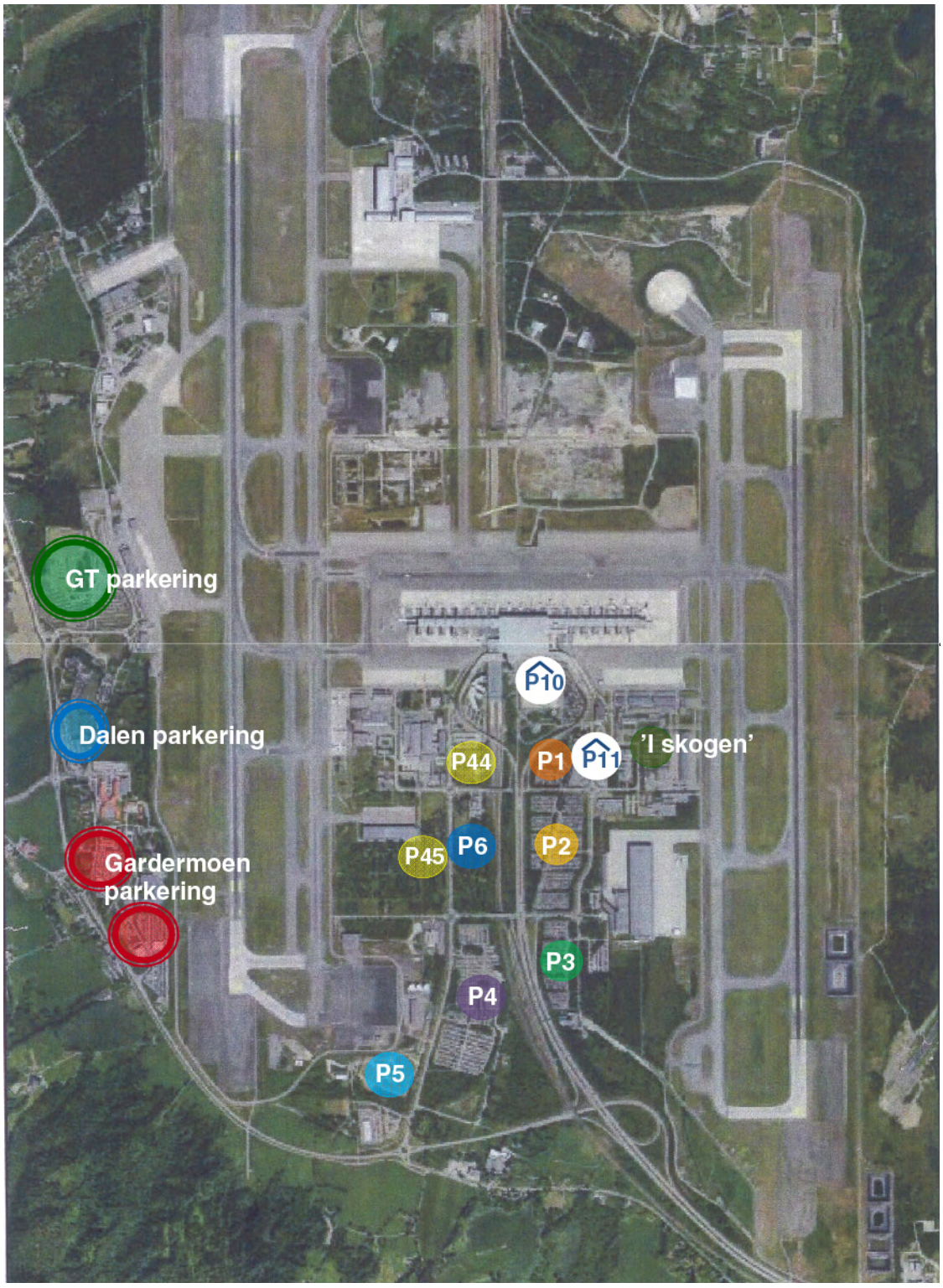
Parking capacity at the airport has increased gradually in line with demand. Both passengers, employees and visitors currently have good and adequate parking facilities. This applies both to the facilities on OSL's area and the surrounding private parking facilities. Facilitation of good parking services is decisive in order to satisfy requirements and aspirations toward good accessibility. At the same time income from this parking is an important source of income for OSL and other parties. With continued growth in air traffic, demand will increase significantly.

An overview of combined parking capacity appears in the table below. The figures outside of the airport area are approximate. The location of the most important parking facilities are shown on the aerial photo on the next page.

Parking spaces:	For passengers	For employees	Other	Total parking spaces
OSL	1) 15,516	2,593	676	18,785
Other in airport area		750		750
Total in airport area	**15,516**	**3,343**	**676**	**19,535**
Gardermoen Parkering	2,800	-		2,800
GT Parkering	2,000	-		2,000
Dalen Parkering	2,800	-		2,800
Other parties	400			
Hotel, conference, etc		-	1,300	1,300
Total outside of airport area	**8,000**		**1,300**	**9,300**
TOTAL	**23,516**	**3,343**	**1,976**	**28,835**

1) includes approx. 750 spaces that are used for hotels, conferences, etc. in the airport area, in addition to 900 spaces – reserve spaces - for summer use.

The parking facilities at Gardermoen inside and outside of the airport area.



Aerial photo of Oslo Airport Gardermoen indicating the parking facilities within and close to the airport area.

The combined parking capacity for OSL and other parties currently constitutes approx. 28,800 parking spaces. Of these approx. 22,750, or just less than 80% are intended for air passengers. No distinction is made between short-term and long-term parking here.
Private parties outside OSL's area have in recent years significantly expanded their parking services and currently provide approx. 8,000 spaces. In addition there is hotel/conference parking with approx. 1,300 spaces. Within OSL's there are a total of 18,785 spaces, whereof 8,485 are covered. Of these 15,500 spaces are reserved for passengers, the remainder are for employees, etc.

The parking requirements in the time ahead are stipulated in the table below. Three alternative forecast figures for growth in parking requirements have been drawn up, depending on whether the point of departure is the growth in the number of air passengers, the growth in annual average daily traffic as stipulated by us, or whether one also includes a change in traffic patterns where more are dropped off at the airport rather than driving themselves and parking. The models also provide somewhat differing figures for parking space requirements in the longer term.

This represents perspectives that all may be viewed as trend projections with somewhat varying assumptions. Changes in the public transport share are due to external factors and changes in car usage patterns may be due to a generally high price level for parking at the airport. Which forecast figures to use is a matter of debate, but they can also be perceived as merely an expression that given needs arise at somewhat differing times. We presume that a practical approach will be close to the two lowest requirements. This indicates an increase in requirements in the range of 50% up to 2025 and a doubling up to 2040.

Forecast basis	**Development in number of parking spaces for air passengers in the case of HIGH forecast**			
	2007	**2012**	**2025**	**2040**
Growth rate for number of air passengers	24,400	27,800	43,500	72,200
Growth rate for total AADT to/from airport	24,400	26,600	38,600	56,400
Assumed growth rate for AADT parking	24,400	25,900	33,100	42,700

Developments in requirements for parking paces 2007 – 2040 for air passengers in case of HIGH traffic forecast, based on different growth rates.

The assessments also indicate that without an increase in capacity in the years ahead, exploitation of the service will become so high that the parking situation at Gardermoen will be perceived as difficult in 2015.

Park and ride – transfer to train and express buses
OSL is a traffic hub with very good public transport services for passengers, with both buses and trains. As a stage in a general strategy to increase the share of public transport in the region, there has for a long time been a desire to establish a major parking facility at Gardermoen for park-and-ride for local travellers to Nedre Romerike and Oslo from a natural catchment area around the airport. In functional terms this could be ideal for road users, but it is probably incompatible with both the pricing of the parking service and the scarce land resources close to the terminal points at the airport area. Such park-and-ride parking is important to achieve higher public transport shares to/from the areas around the airport, but the service would probably have to be established at other locations with good public transport services. For access to trains this could mean park-and-ride and a new train station for local trains on either the Gardermoen line north of the airport or on the main line at e.g. Dal station.

Parking service versus public transport shares for traffic to/from the airport
Limitations on the number of parking spaces combined with restrictive regulation of parking services, e.g. in the form of increased parking fees, are often mentioned as possible instruments to stimulate increased use of public transport. For employee parking car use may also be influenced if one were to change tax regulations related to free or subsidized employee parking. However, experience shows that the effect of such limitations is usually moderate and that strong measures are required to achieve radical change.

In general, the use of such instruments will reduce access to the airport unless one also compensates through significant improvements to public transport. This may be possible for some travel relations where the traffic basis is large, e.g. towards Oslo, but not for the majority of travel relations where both the traffic basis is too small and where quality and competitive ability for public transport cannot be adequately developed. For some travel relations the service is so poor that passengers in reality have no options in terms of mode of transport. Parking restrictions cannot be used without reducing accessibility for a significant number of travellers to the airport.

Instead of measures directed at parking at Gardermoen, the use of road pricing/toll roads for traffic towards Oslo may be a more targeted and better instrument. However, here too one will reduce accessibility for road users using the E6 and who cannot use the good public transport service to Oslo.

Parking service – future regulations
The parking service outside of the airport area consists of parking companies that provide the lease of parking spaces to passengers, and parking spaces in connection with various airport-related undertakings such as e.g. hotels, conference centres and bedsit rentals, catering, etc. The private parking companies have grown significantly in recent years, and continued initiatives for expansion must be expected in time with future growth in air traffic., ref. the tables of current facilities and expected future requirements.
OSL and operations outside of the airport area will always compete and adapt their parking services and the regulation of this in relation to each other, regardless of whether the authorities get involved with regulation or not. On the other hand, it is reasonable to expect that the authorities have opinions on where and how this service should be organized in terms of traffic as well as business and the environment, and that they thus should take on general responsibility for this important area.
If it should become a goal to use parking facilities and parking regulations as an active instrument to influence e.g. the distribution between cars and public transport, it would be very important that authorities allow for comprehensive evaluations and management of the entire parking service, both within and outside of the airport area.

For more detailed information on this work, refer to attachments 4 and 5:

- OSL Terminal 2. Parking and public transport share. Prepared by the Institute of Transport Economics (TØI) Date 4 July, revised Oct. 2008
- Sub-report on regional/local feeder traffic, transport, parking and works traffic. Carried out by Møreforskning Molde AS. Date 1 December 2008, revised April 2009.

3.5.4 Spin-off effects – trade and industry, employment and settlement

History
When the Storting decided in June 1990 to plan Gardermoen as a new main airport, localization was also intended as an instrument to strengthen development north of Oslo and the eastern Norway region in general. The Storting therefore requested that a planning project was carried out in cooperation with the county municipalities and affected municipalities, with the aim of facilitating regional development. This project was carried out in parallel with the other planning work for Gardermoen (airport and feeder system) and was a part of the collective planning and evaluation work. The regional planning project focused on Oslo and Akershus counties, but also included assessments of the airport's importance for Hedmark and Oppland. It comprised a description of the indirect/regional effects of the Gardermoen project (airport and feeder system) and an eventual relocation of parts of the armed forces' activities in the Gardermoen area (The Armed Forces' planning project). The project is summarized in a “Main report – Regional effects of the main airport at Gardermoen”, dated December 1991. Results/conclusions from this work are not referred to, but are summarized through that the development of Gardermoen as the main airport would be one of many factors that would affect regional developments in eastern Norway. Based on the forecasts for air traffic growth and number of airport employees that were available at the time, the development of the airport and feeder system would be a key factor for the development of eastern Norway for the next 30 years.

Completed analyses and studies
Subsequently several studies and analyses of the spin-off effects have been carried out both before and after the opening of the new main airport at Gardermoen.

In 1996–97 the first study was carried out that reviewed the effects of Gardermoen and Fornebu as of 1995 This was followed up in 2001-02 by a new study, after Gardermoen as main airport had been in operation for three years. The third and latest study documents the situation as of 2005 and some development trends in the period between 1995–2005. The surveys/studies are primarily carried out by the Institute of Transport Economics (TØI). As a stage in developing the county sub-plan Gardermoen 2040 – Strategic development plan for Gardermoen, TØI also summarized the previous reports and included some perspectives on the future in 2005. The main content of this chapter is reproduced from the documents mentioned.

Effects
A rough distinction is made between direct and indirect (consequential) effects. The direct effects are defined as effects dependent on operations such as employment, income, added value, production and taxes, which in their entirety or majority may be related to operation of the airport. Most of these, but not necessarily all, will be located at the airport area.
Indirect effects are generated by the direct effects and are expressed in the economy as subcontractors of goods and services to these, independent of location. Some of these may be easy to identify, others much harder, because only parts of their activities are related to the airport.
There are also induced effects (generated by the consumption of the income of the direct and indirect effects) and catalytic effects (employment, income/added value, etc. as a consequence of economic development generated by airport-dependent access to the market). The latter are difficult both to identify and quantify.

The spin-off effects are both real and quantifiable and they are significant. The effects may be felt all over the country and internationally. In different ways it may be attempted to increase the spin-off effects and to spread more of them to areas west, north and east of the airport. A development has been recorded where many effects are already present in the area around the airport, but the potential for the local area's share of the total effects has not yet been reached.

Employment
At the time of the latest study in 2005, there were 12,300 employees at the airport, which represented approx. 10,500 man-years. These included 8,000 airline employees and employees of related services such as handling and maintenance. 800 were employed by OSL and with public authorities (customs, police, post, ambulance), while hotels, restaurants and retail employed 1,350. The Norwegian Armed Forces had 250 employees, while 1,800 were employed in other services such as transport, security, cleaning, parking, etc.

TØI's point of departure is that there is a positive correlation between passenger growth and direct airport employment and presumes that employment will grow in time with traffic development. The number of passengers in 2005 was approx. 15 million. This provides a key figure of approx. 800 employees per one million passengers, which is slightly below but almost at the same level as the average for European airports.
The number of employees has grown in time with traffic growth at the airport, and was close to 15,000 in 2008. It is assumed that the distribution between the different sectors is the same as in 2005. TØI refers to an increase from 12,000 employees in 2005 to 21,000 employees in 2020, based on 26 million passengers in 2020. According to the forecasts that indicate 30 million passengers in 2020, this will correspond to approx. 24,000 employees, i.e. 9,000 more employees at Gardermoen toward 2020.

In terms of calculating the indirect effects in relation to employment, a multiplier is used, i.e. a relation between different effects to estimate the spin-off effect employment and total employment. When this average multiplier is used, it indicates that every employee in function directly related to the airport creates 2.5 indirect and induced jobs.
Based on this, Gardermoen/Fornebu created approx. 35,000 jobs. Based on the fact that the same number of direct employees were found in both 2001 and 2005, for these years Gardermoen represents approx. 43,000 jobs.
If the same multiplier is applied to the assumed direct employment of 21,000 in 2020, this corresponds to total employment (not including catalytic effects) of 73–74,000 persons in 2020. See below figure.

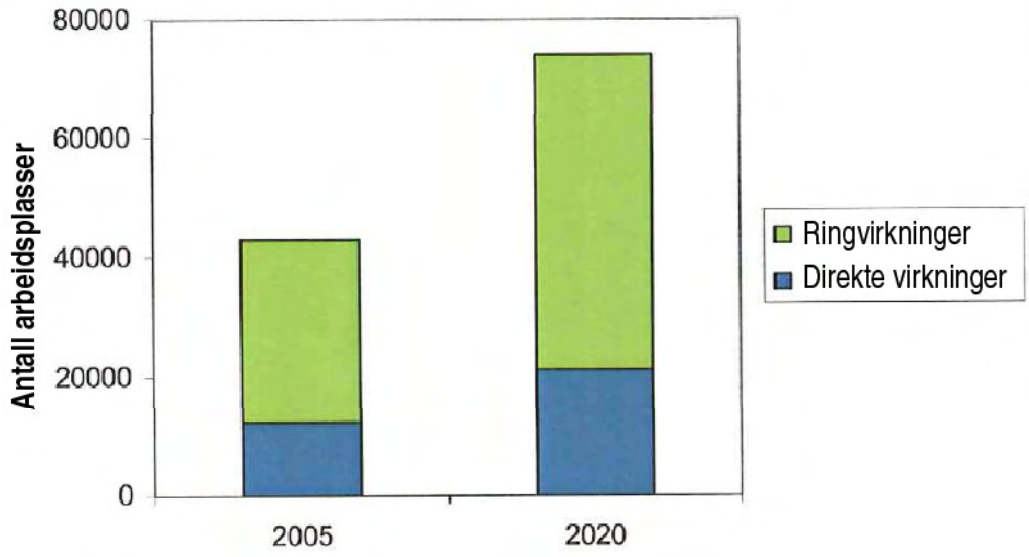


Figure that shows direct effects and spin-off effects in relation to number of jobs in 2005 and 2020.

It has been easier to count the number of employees at the airport and distribute these among their home municipalities than attempting to analyse the secondary effects on industry.
Innovasjon Gardermoen (IG) is a network and interest organization for businesses in eastern Norway. IG has in recent years had more than 200 members, and these member businesses represent indirect effects. They have therefore been used in TØI's studies to survey indirect effects and which geographic structure that shows where subcontractors to undertakings that are directly related to operation of the airport are located.

As early as three years following the opening, a pattern was established that continues to the present. Two areas have a strong dominance; one is the local area in Ullensaker, i.e. Gardermoen – Jessheim. The second and most important is Oslo, which has approximately the same supply share to Gardermoen today as it had to Fornebu ten years ago. Ullensaker and Oslo have a total of approx. 75% of supplies to the airport. There also appears to be a tendency to concentration in the corridor towards Oslo, Øvre Romerike beyond Ullensaker, while the local areas north and east are only sporadically represented in this connection.
In light of Oslo's role as capital, there may be an upper limit to the share that other areas can achieve in the future. If this is a correct assumption, it creates a major challenge if the aim is to distribute the increased spin-off effects over a larger geographic area that what is presently the case.

Strong local and regional growth
The air passengers' consumption in the visited region has increased significantly and faster than air traffic. However, most consumption occurs in Oslo. In the future perspective it is therefore particularly interesting whether the local regions, employing specific measures, will succeed in turning this consumption pattern to their advantage. The population development and population forecasts draw a clear picture, characterized by very strong local and some regional growth, both compared to the previous situation and to other areas. Local and central forecasts indicate that these developments will continue.
A different question is how these effects are distributed geographically. No one has the opportunity to gain a full overview of this distribution, because there will be a number of other trends and localization strategies that carry a lot of weight. It may be implied that more than 30% of the direct, indirect and induced employment includes employees that could reside in Øvre Romerike, and a higher share with respect to certain sub-categories.

Settlement
It has been difficult to relate effects to geography through the studies carried out by TØI due to resource reasons and for other reasons. The most reliable distribution is available for the direct effects,

where the settlement pattern is quite accurately surveyed. As early as three years following the opening, Øvre Romerike and particularly Ullensaker were the centres of gravity for settlement for employees at Gardermoen. These developments have continued, with an increased share in Ullensaker and corresponding reductions in Asker and Bærum in particular.

In 2005 there were two approximately equal centres of gravity in settlement terms: Romerike and Oslo/Asker/Bærum, each with a 35–40% share of employees. However, developments in recent years have been such that Romerike's share is the largest, as opposed to previously. In Øvre Romerike Ullensaker stands out with as large a share as the rest of Øvre Romerike combined. A smaller share lives in Hedmark/Oppland, other places in Norway and abroad. See figure on next page.

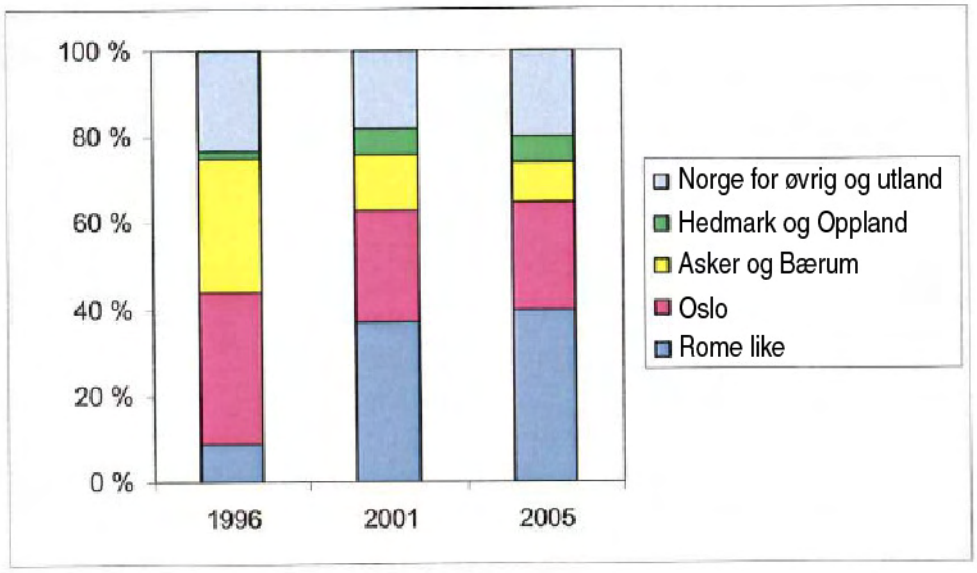


Figure showing employees at main airport, distribution of settlement 1996-2005

Population developments

In its studies and analyses TØI has looked into the relation over time between developments in population figures and the establishment of the main airport, and have also discussed commuting and studies of regional strength and competitive ability.

All indicators point in the same direction; that much has happened locally and regionally as a consequence of the airport development and that indications of a cause and effect relationship are extremely clear. TØI has compared changes in population figures over time for various municipalities and regions in Akershus, and refer to Statistics Norway's population projection, which illustrates a relatively long time perspective.

1995, 2000 and 2005 correspond to five-year periods that are relevant to compare with each other. 1995 represents the “before-state” in that the airport opened in 1998, 2000 represents an approximate starting point and 2005 the present situation.

During the “before-state” from 1995-2000 all of the regions in Akershus experienced approximately the same growth rate. Ullensaker municipality's population numbers grew in line with the county average. In the “present situation” 2000-2005 the picture changed. Øvre Romerike was then the only region with a higher growth rate than during the previous five-year period. Ullensaker stands out with a growth rate almost three times as high as the previous period, and twice as high as the Akershus municipality with the second-highest growth rate, Nannestad. At the same time a certain tendency for growth above the average is seen in some municipalities in Nedre Romerike – Aurskog-Høland, Sørum and Skedsmo.

The table below (with population figures from Statistcs Norway) shows population growth from 2000-2008, compared for the municipalities closest to the airport, the Gardermoen region combined, Nedre Romerike, Akershus and Oslo.

Municipality	1 Jan 2008	Growth 2000-2008	Growth in %
Ullensaker	26,934	6,774	33,6
Nes	18,510	2,222	13,6
Eidsvoll	19,916	2,392	13,7
Nannestad	10,657	1,690	18,9
Hurdal	2,581	-67	
Gjerdrum	5,464	910	20.0
The Gardermoen region	84,062	14,016	20,0
Nedre Romerike	161,497	17,514	12,2
Akershus	518,567	51,515	11,0
Oslo	560,484	53,017	10,4

In total this provides indications of very significant population-related effects on the airport's local surroundings, i.e. Ullensaker municipality, but also beyond this area, particularly in the corridor towards Oslo.
Trends in the long-term perspective towards 2020-2025 also indicate that Øvre Romerike will grow faster than the rest of the county.

Commuting
In the 1990s, before the main airport at Gardermoen was opened, Ullensaker was a commuter municipality. More than half of the workers living in the municipality worked in a different municipality. The main airport has led to a distinct change in the trend, to a large net influx of commuters.

Other spin-off effects
Transport is not enough to achieve increased regional growth. If Gardermoen is to contribute to regional development in the capital area and the interior, there must also be focus on building expertise. The interior is best in the country in terms of adventure travel, and Oslo and Romerike lead the way in the course and conference market.

3.5.5. Socio-economic analysis – benefit to society

Aviation - sustainability and social benefit
In a separate project called “The social benefit of aviation,” initiated by Avinor with the participation of other aviation players (NHO, SAS, Norwegian and Widerøe), the aviation sector in Norway has focused on challenges and the measures that can contribute to sustainable and socially beneficial aviation. The major environmental organizations have also participated in the work.
The report emphasizes that the main task of Norwegian aviation is to contribute beneficially to social development in Norway by providing safe, efficient and eco-adapted air transportation within all regions of the country and to make arrangements that enable the nation to participate actively in global economic and social development. The National Transport Plan (2010-2019) stipulates the following targets for the transport sector: “To offer an efficient, accessible, safe and eco-friendly transportation system that covers society’s need for transportation and promotes regional development”.

The UN climate panel (IPCC) concludes in its fourth major report from 2007 that it is highly probable that human emissions of greenhouse gases have been the main cause of the global temperature increase since the mid-20th century. If emissions are not reduced, the global mean temperature will continue to rise. Resolving the climate problem is a major social challenge. Aviation industry operations involve the emission of greenhouse gases and the industry therefore has a responsibility to find solutions for the environmental challenges.
Viewed in isolation, the industry's objectives may seem to be pulling in different directions, and balancing the various considerations relative to one another is a challenge. In the public debate, for example, calls have been made for the growth in air traffic to be halted in order to reduce greenhouse gas emissions. At the same time, attention is often focused on how important aviation is to Norwegian society and that developments desired in many areas make considerable air traffic a necessity. Examples of this include the objective of increasing tourist traffic to Norway, the need to decentralise the structure of trade and industry, public expectations of nationwide access to good health services and emergency preparedness, and the oil industry's reliance on air transportation.
Collectively, the aviation industry in Norway recognises the challenges mentioned above and would like to make a positive contribution to social development. This is the background for implementing the aforementioned project. In the industry's opinion, there are two scenarios that ought to be avoided:

- An increase in emissions in conjunction with the growth in air traffic because the environmental consequences would be too great.
- A controlled restriction of air traffic growth because that would have negative social consequences.

Within this project, Avinor and the Norwegian airline companies have been investigating initiatives to increase the ability of aviation to meet both the social and environmental challenges. The work has concentrated on the areas for which the industry itself has responsibility and over which it can have an influence, but the project has also been looking at initiatives within associated areas, such as feeder services to the airports.
One of the project's goals has also been to contribute to a comprehensive presentation of the social benefit and environmental impact of the industry.

Airport coverage is very good in Norway, and aviation contributes to linking the country together. The administration of the country's resources and the political goals for settlement in the regions have guided the building and maintenance of the airport network. It has been shown that two out of three residents have access to an airport within a journey time of one hour. The cover is particularly good in western and northern Norway. The significance of this can also be illustrated by the fact that 99.5% of the population are able to travel to Oslo and get back home again on the same day.
The industry helps provide 60,000-65,000 jobs, which is of particular importance in the regions. Overall, aviation has an impact equivalent to 4% of the country's GDP.

In an assessment of aviation as a means of transport, consideration must be given to the alternative means of travel that exist. In general, it might be said that for relatively short flights, there may be satisfactory alternatives, whereas for long journeys there are no real alternatives.
An independent report prepared in connection with this documents aviation's social and economic importance for the development of the country, hereunder regional development, globalization and social welfare. It concludes that there would be significant negative effects if possible measures to reduce or stop growth in aviation were implemented. One of the important discoveries in the report is that only a small share of passengers have alternative modes of transport than air. The alternative would be to not travel.

Socio-economic analysis of the chosen concept for Terminal 2
As previously mentioned, Terminal 2 is part of a larger project in connection with the National Transport Plan 2010-2019. As a basis to assess the choice of concept and as a step in an application for an amended licence as a result of Terminal 2, a separate socio-economic analysis of Terminal 2 has been carried out. (Carried out by Møreforskning Molde AS.)

The report provides an assessment of socio-economic factors related to expanding the airport to serve the expected growth in traffic.
The basis for T2 is expected growth in traffic in the period until 2035. The analysis only looks at the development of phase 1. Phase 2 will, independently of traffic developments, may be deferred towards

the expiry of the analysis period (2032). If traffic grows faster than assumed, Phase 2 will occur earlier, but the benefit of such a measure will consequently also occur earlier. An omission of phase 2 is not considered to affect conclusions.
The main elements of the socio-economic analysis part of T2 are related to the additional socio-economic costs that will arise if some of the traffic has to find other routes if OSL has capacity problems. It is estimated that the bulk of this traffic will then use Moss Airport Rygge and Sandefjord Airport Torp. The analysis has been run with different alternatives for this. The capacity conditions for the two relevant alternative airports have been considered in order to be able to say something about when eventual development measures must be carried out there in order to handle spillover traffic if Terminal 2 is not developed. The costs of increasing capacity at Rygge and Torp have not been calculated. The effects of other sharing of roles between the airports in eastern Norway have not been considered. This also applies to the effect of developing high-speed trains in Norway. In any case this is in all likelihood far into the future.
Effects of changed emissions to air, as a result of changed fuel consumption (reduced flight times/longer flight times, longer/shorter feeder transport) have also been considered.

Conclusion
Based on the analyses that have been carried out, it is concluded that Terminal 2, and the chosen V6 concept, appear to provide good socio-economic profitability. This applies even though not all economic effects are fully quantified. Even in the case of a relatively simple procedure for performing the analysis, it is concluded that the profitability of the measure is robust, particularly when the costs for the expansion of capacity at alternative airports are considered, if the terminal capacity at OSL is not expanded.
This will contribute to increasing the socio-economic benefit of Terminal 2 further.

3.6 Consequences of the building and construction activities:

General remarks
Currently only a preliminary draft project for the Terminal 2 measure is available in the form of the winning project. This does not provide sufficient basis to assess details concerning the scope of building activities, the number of people and how much traffic the development will generate. The assessments here are therefore based on experience and preliminary considerations and assumptions.
The locations of the two site areas do however appear to be reasonably well established. The planned locations are shown on the map on the following page. Here the location of eventual deposits and production areas for surplus material, asphalt/concrete in Hovinmoen are also indicated.

Consequences for traffic
A comparison with the development in the 1995-98 period indicates that up to 1500-2000 persons may work at the site for longer or shorter periods. 1000-1300 persons may be assumed to work on the expansion of the actual terminal facility, while 500-700 persons will belong to the building site to the north. If progress changes and the scope of the first phase of the development is reduced, these figures will be far lower.

For the southern site area we have assumed that traffic to/from the area will use the existing road network. For the northern site area the works traffic will have to use Blikkvegen from the east and Nye Aurveg from the west and on to the site area through a northern gate in the airport fence, east of Gardermoen Flystasjon.
The location of the site areas and assumed distribution of works traffic is shown in the figure on the following page.

Experience indicates that a majority of the workers will use cars to/from work/building site, possibly as many as 80%. Based on the aforementioned figures, an increase in the average annual daily traffic of 500-600 vehicles may be expected on the local road network around the airport. The largest share of this traffic must be assumed to enter/exit the airport area to the north, where most of the works-related traffic will go. In addition, deliveries will constitute a significant proportion average annual daily traffic, estimated at 200 vehicles/day.
The transport of material may constitute the largest strain on the local road network. OSL has provided a preliminary estimate for net material moving of approx. 430,000 m^3 gravel that must be removed form

the airport area and approx. 28,000 m^3 of asphalt that must be transported in. Given that each truckload takes approx.16 m3 of gravel and 20 m^3 of asphalt, this corresponds to around 30,000 gravel loads and 1,400 asphalt loads in the 2009-2012 three-year period. Gravel transport is assumed to take place mainly in 2010/2011, and asphalt transport in 2011/2012. More accurate estimates are dependent on a more detailed plan of progress for the Terminal 2 project, and may as previously mentioned be somewhat delayed.

Excess material from the works is assumed, as of today, to mainly be reused or deposited within the airport area. However, in a worst case scenario it has been assumed that some material will have to be transported from the airport area.

For gravel transport this is assumed to take place for a period of 18–20 months. With 12 hour shifts and 5 day weeks this corresponds to 10-15 trucks an hour in both directions and an average annual daily traffic of 150-200 vehicles/day. However, this figure will probably be reduced significantly.

Asphalt transport is expected to take place for a period of approx. 30-60 days, given that asphalt can be laid relatively consecutively and that the asphalt plant has a capacity of 200-300 tons/hour. The contribution to the average annual daily traffic will in this period be 50–150 vehicles/day.

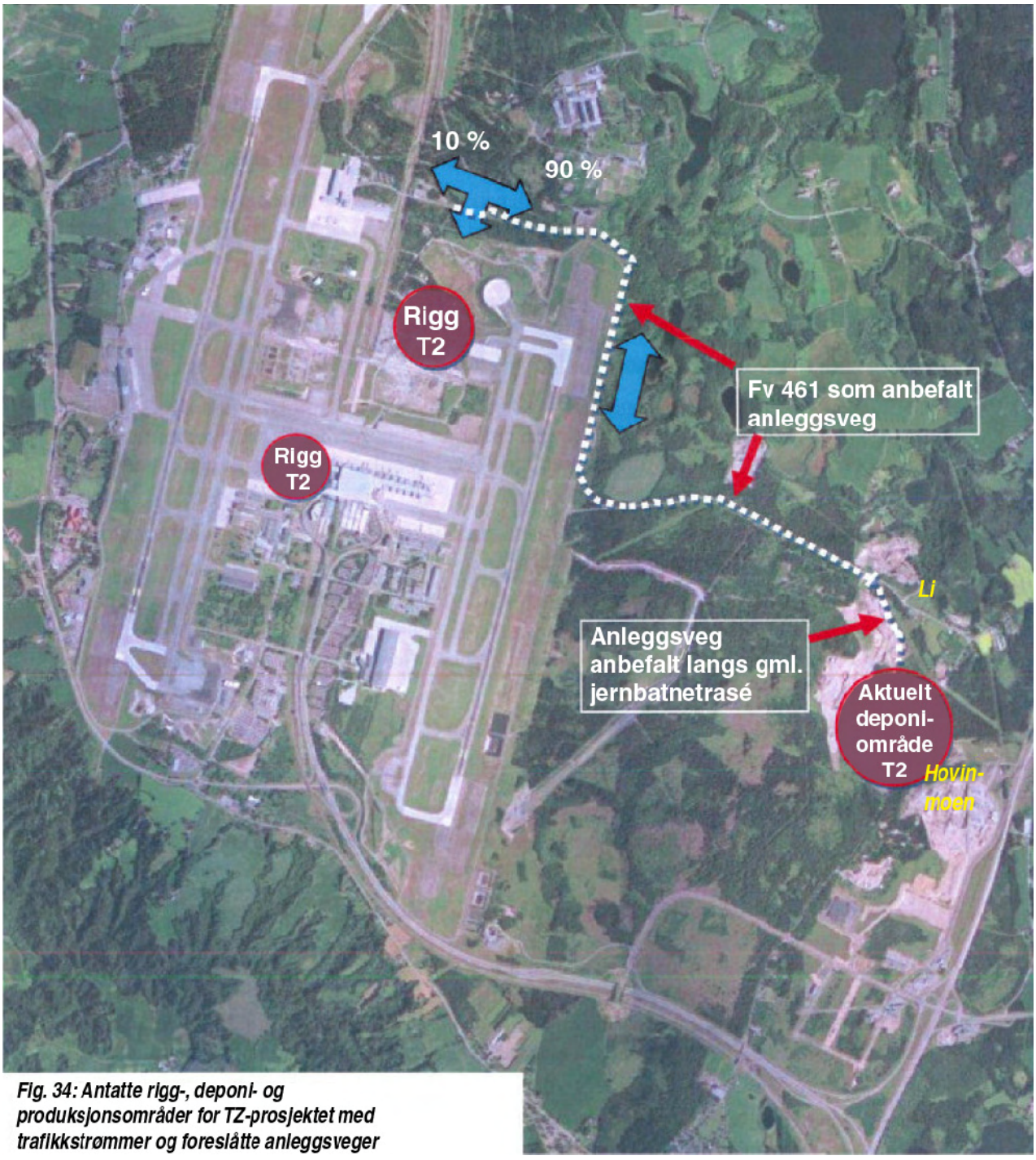


Fig. 34: Antatte rigg-, deponi- og produksjonsområder for TZ-prosjektet med trafikkstrømmer og foreslåtte anleggsveger

So far it is not clear whether concrete production will take place inside or outside of the airport area or how extensive production will be. For this reason there are no production volumes that can be extrapolated to eventual traffic figures/average annual daily traffic on the surrounding road network. A rough draft of developments in transport loads on the road network in the north-east (without concrete production) may be as illustrated by the figure on the next page.

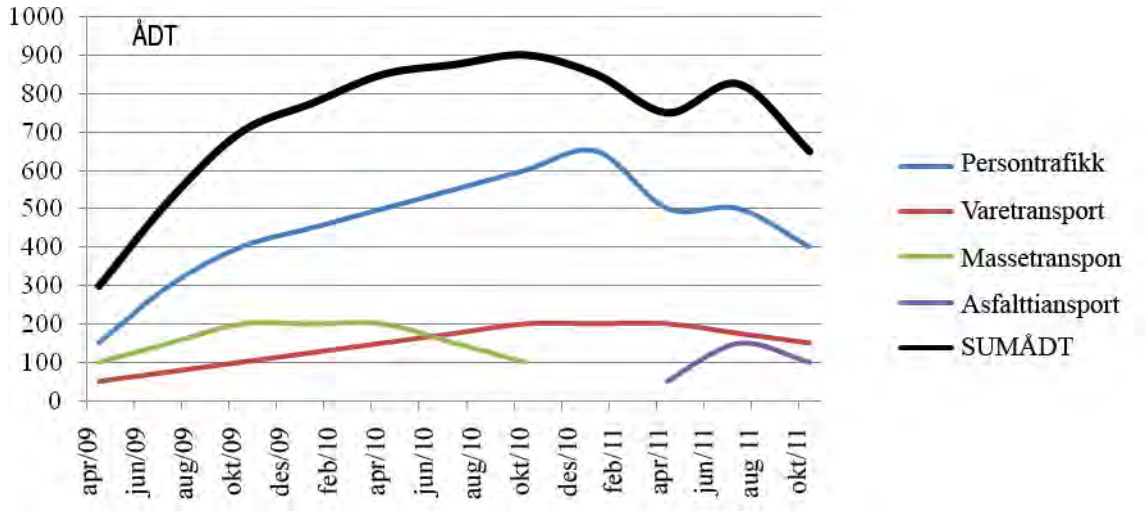


Figure showing how traffic could develop during the construction period. (The figure is not adjusted according to changed completion time for the project in 2013/2014)

Works roads

It is expected that the bulk of material transport – around 90% – will take place in the area between the works area to the north and eastwards to/from Hovinmoen and the E6 road. The remaining traffic will go west towards Nannestad. The traffic eastwards is assumed to be distributed as 20% to/from the E6 and 80% to/from the Hovinmoen area.

Trunk road 461- Blikkvegen, has very good capacity reserves. The current average annual daily traffic on Blikkvegen is a modest 1,000 vehicles/day, and will in the most hectic building period have an additional load of approx. AADT 900. This is still well within the capacity limit.

Blikkvegen is also adequately scaled in terms of load-bearing capacity to carry this works traffic.

Trunk road 461 'Blikkvegen' viewed from the south, parallel with eastern runway.(Photo: ØRP)

Traffic, noise and dust – remedial measures
A significant portion of the works traffic may inconvenience the road's neighbours with noise and dust. This will have few consequences for the main part of the road up to Hovinmoen/Lie, but may have significant negative effects for residential areas at Lie.
Remedial measures may be implemented in terms of noise, dust and traffic safety conditions on the existing road, but due to the close proximity to homes, the effect will be limited. A possible solution may be to establish an approx. 800 m long works road on the disused railway line south of the residential area at Lie. See previous map/figure.

Noise screening may be efficiently achieved with a barrier along the entire works road, between the road and homes.

The dust problems may be prevented through dust-binding of the works road, or by considering a closed surface on parts or the whole of the stretch. The noise barrier will also contribute in this respect.
Traffic safety is improved by leading works traffic outside of the residential area. Reduced speed may be considered at the entry/exit area for the works road.
If desirable, the works road past the residential area may in the longer term be upgraded to a permanent national road and be included in the future feeder road network for Gardermoen Industrial Estate, as indicated on the map illustration.
The aforementioned issues will be clarified in connection with further detailed planning.

4 SUMMARY AND COMPILATION OF ISSUES/CONSEQUENCES

Issue:	Short description – consequences and relevant measures:	Consequences of measure and/or traffic	Consequences in construction	Responsibility for follow-up/measures
CONSEQUENCES FOR THE ENVIRONMENT				
Emissions to air	Local air quality is affected by both air and road traffic + residential heating and other sources. The total emission volumes are approximately proportional to traffic volumes. Measure: Monitoring takes place continuously and is reported regularly. Measure to reduce emissions are planned and partly implemented.	Increased emissions are a consequence of increased air traffic and increased traffic/activity in general.	Primarily operational phase.	OSL – for air traffic and traffic/activities inside airport. Other: relevant parties.
Water and ground, waterways and pothole lakes	New facilities will affect the water household. More asphalt surfaces and roof surfaces. Increased use of chemicals as a result of greater aircraft activity. Increased infiltration of clean surface water. Increased need for treatment of polluted surface water. Need for increased pump capacity and storage volumes. Measure: Regular monitoring/control of discharges and water balance is carried out. Existing plant/capacity for managing water and chemicals must be expanded to cope with new development and increased aircraft	Consequence of measure, but also of increased aircraft activity in general, and increased activity in general.	Primarily in operational phase, but measures also required during construction phase.	OSL and parties involved in development.
Cultural environment – architecture/design	The design manual provides guidelines for the development. Compliance assumed in the project.	T2 measure		OSL – planners
CONSEQUENCES FOR NATURAL RESOURCES				
Energy solutions	Flexible energy solutions must be chosen that allow for the use of alternative energy sources. The energy requirements of the new terminal must be significantly lower than in the existing terminal. Measure: New buildings designed an planned such that a significant share of the energy requirement is covered by other energy supply than electricity and/or fossil fuels. Will be clarified in continued detailed planning.	T2 measure		OSL-planners
Material extraction – raw materials for building	Relevant material extraction; - use of local material, surplus material and need for additional material to the site (gravel, stone, etc.) will be clarified in further detailed planning. Measure: A separate material disposal plan must be prepared for the site.	T2 measure	Primarily building and construction phase.	OSL - planners

CONSEQUENCES FOR SOCIETY				
Aircraft noise	There is currently a noise zone map prepared in accordance with previous guideline T-1277 from ME. New regulations for approach and departure for OSL are being considered by MTC. Until these are adopted, it is not considered appropriate to draw up new, official noise zone maps. Nevertheless, with basis in the applicable regulations, a map has been drawn up in accordance with the T-1442 guidelines for calculating noise zones in order to illustrate the future noise situation. Measure:	Consequences as a result of increased air traffic or changed runway use and aircraft paths. New regulation pending.	Operational phase.	OSL-LT-SD
Feeder traffic – transport network	Traffic volumes related to those who start/conclude trips at OSL, in addition to employees and visitors. Feeder traffic increases with increased air traffic and higher activity in general. Local road network has good capacity in time ahead. E6 will have capacity problems in a few years. Pedestrian/bicycle traffic also to be considered. <u>Measure:</u> Facilitate continuous pedestrian/bicycle network. E6 must be expanded southwards.	Consequences as a result of increased air traffic and general activity and thereby increased traffic and activity in general at and in the vicinity of the airport.	Operational phase	The relevant authorities and transport bodies: County/ministry County municipality Municipalities Public Roads Administration National Rail Administration (incl. NSB and Airport Express Train) OSL
Public transport – public transport share and parking facilities	OSL currently has a public transport share of 60%. Best in Europe, but aims to increase. Public transport and coverage good towards Oslo, but poor locally, particularly along east-west axis. Need for increased parking facilities at airport will arise, regardless of increase in public transport share. Increases in time with air traffic and with increased activity in general at and in connection with the airport. <u>Measure:</u> Better local bus connections are necessary to increase use of public transport. Need for increased parking facilities in long term, regardless of increase in public transport share. Airport Express Train and NSB have initiated	Consequences as a result of increased air traffic and general activity and thereby increased traffic and activity in general.	Operational phase	Same as above.
Spin-off effects – trade and industry, employment and settlement	The development of the main airport has led to major ripple effects both locally and regionally in connection with business, increased employment and settlement. Greatest effect in the corridor towards Oslo and the closest municipalities, particularly Ullensaker. Several assessments and analyses describe this.	Consequences as a result of localization of the main airport at Gardermoen. Increases in time with increased air traffic and increased activity in general.	Operational phase.	County County municipality Affected municipalities. OSL and all parties in general.

Socio-economic analysis – benefit to society	The completed project “Aviation's benefit to society” emphasizes the main role of aviation, which is to contribute to good development of Norwegian society through safe, efficient and environmentally adapted air transport in all parts of the country. Aviation has great social and economic significance for the development of the country. There would be significant negative effects if measures to reduce or stop growth in aviation were implemented.			Various authorities and parties
Socio-economic analysis of T2	A basic analysis has been carried out that concludes that Terminal 2 will provide good socio-economic profitability.			
CONSEQUENCES OF THE BUILDING AND CONSTRUCTION ACTIVITIES				
Consequences for traffic	The development may lead to significant traffic increases on the local road network around the airport. Particularly in connection with the northern site area. The scope of works traffic, goods transport and material transport will only be clarified through further detailed planning. <u>Measure:</u> Noise barriers, asphalting, etc. It may also, depending on volume and type of traffic, prove to be necessary to build a separate works road past the residential area at Lie.	Consequences of building and construction activities.	Building and construction phase.	OSL and parties Involved in the development.
Traffic, noise and dust nuisance	Works traffic may inconvenience the roads' neighbourhoods with noise and dust nuisance. In general this is not considered a problem, except close to residential areas, e.g. at Lie. Will be clarified in further detailed planning. <u>Measure:</u> Dust binding and asphalting of gravel roads. Construction of works road for part of the section, as described above. Other traffic safety measures such as reduced speed in certain places.	Consequences of the building and construction activities.	Building and construction phase.	OSL and parties involved in development.

5 PREPAREDNESS – RISK AND VULNERABILITY ASSESSMENTS

Introduction
OSL is as a limited company a separate legal entity and has an independent role toward the authorities in relation to mandatory statutory requirements. As a consequence OSL has a separate system for management and administration of its operations. Through this system, which is based on relevant ISO requirements, quality improvements are ensured, including safety, security, health, environment and the safety of employees.
The company's operation documentation consists of a number of governing manuals/specifications (for the different areas), local regulations, procedures, instructions and work descriptions. There are also guidelines for the preparation of preparing procedures, instructions, work descriptions and other help documents.
Monitoring and metering of operations is maintained through a combination of inspection routines, test/metering programmes and electronic systems. Routines for metering, monitoring and processing data are documented in the company's operation documentation. Examples of such systems/routines are ground radar, terminal radar, management/regulation/monitoring systems related to technical installations, security, etc., friction measurements, control and monitoring programmes for water, noise and route monitoring.
There are also guidelines/routines for handling incidents and irregularities, corrective and preventive measures and an auditing programme with an overview of audits and inspections that are planned, with procedures for these.

An overarching Safety and environmental management plan and a Crisis management plan are included as components of this management and administration system.
The Safety and environmental management plan describes OSL's subsidiary targets within the areas of Air safety/HSE and Environment/Society, and which activities and measures, beyond regular operations, that are continuously carried out, or whose implementation is planned annually in order to achieve targets. In this there is also an overview of responsibilities and implementation of a number of analyses, audits and exercises.
The Crisis management plan describes the various sub-areas/technical areas within crisis management, and who is responsible for preparing and following up contingency plans within the individual sub-areas. Examples of such sub-plans are; Notification plan (for all types of incidents), Accident and rescue plan, Anti-terror plan, Evacuation plan for the terminal, Procedure for risk and vulnerability assessment, Quarantine/communicable diseases and Contingency plan for the external environment.

RAV analyses/assessments in connection with Terminal 2
The development of Terminal 2 and required RAV evaluations in connection with this, both in terms of the building phase and operational phase, are considered to be fully maintained through the existing management and administration system described.
Analyses/assessments and relevant remedial measures are otherwise, for certain subjects in the IA, described through the relevant sub-assessments and chapters of the IA.
Simulations and risk assessments of different solutions and options have also been carried out during the study and planning work. In connection with this, the following is discussed in particular:

<u>Risk assessment – air safety</u>
In accordance with the Provisions for civilian aviation (BSL), all changes that may affect air safety must be subjected to risk assessments. This is the background for including the requirement toward risk assessments in OSL's management system. The purpose is to uncover risk factors that can be eliminated/minimized through design changes or adaptation of procedures and regulations.

OSL has hired Det norske Veritas to carry out a risk assessment of the approved solution on airside for the Terminal 2 project. This is done with focus on air safety, and the analysis comprises three main sections with subsections:

1 Operation of future taxiway system
- Runway exits
- Taxiing errors

- Conflicts between aircraft
- Conflicts between aircraft and vehicles
- Queues at deicing

2 Operation of future apron area
- Aircraft parking stands and roads around new pier
- Roads and bus system around new pier root north
- New remote aircraft parking area
- Changed conditions around pier root west
- Winter operations
- External roads

3 Risk factors in works operations at a general level
- Generic approach to risk factors and countermeasures during construction work on airside

In the continued planning and implementation work in the project there will be a formal division of phases for the work on airside. Each of the phases will be subject to more detailed risk assessments than those in this general assessment. Thus one will also be more specific concerning issues under item 3 The data basis for the analysis is retrieved through interviews and meetings with the parties working on airside, i.e. airlines, handling companies, catering companies, bus companies, air navigation services, site services and fire and rescue. Veritas is responsible for managing the process, compilation of data, analysis and writing reports.

6 CONTINUED PROCESS – IMPACT ASSESSMENT, CHANGE OF PLAN AND PROJECT

Consideration of IA and change of plan
Ullensaker municipality will as planning authority and in compliance with the provisions of the Planning and Building Act, be responsible for the continued consideration of the present impact assessment and proposal for change of plan (which will be submitted after the impact assessment).
This includes consultation/submission to public review of the IA and planning documents, continued final consideration and final decision by the county council.
Dialogue between the municipality and OSL during this process is assumed, also in connection with assessments and discussions of any comments/statements in connection with consultation. Further proposals for follow-up and possible measures within different subjects/areas. The approved IA and change of plan will form the basis for further applications for measures.

Project progress
The winners of the competition, the planners including architects, chartered engineers, engineers and a number of other professionals within the various technical disciplines, have already started processing the winning draft, i.e. revising that which through the winning project also may be called a draft project. This revision is also being carried out in light of current economic situation in society at large, the decline in air traffic in recent times, and thus the need to more closely consider both the progress and scope of the various phases of the development.
The draft project is assumed to be pursued through the drawing up of a pilot project in the autumn of 2009. Thereafter, further detailed planning will take place within the various parts of the project.
Phase plans will be prepared for implementing all structural measures. The phase plans will describe each individual measure in terms of scope, duration, progress, simultaneousness and any dependencies in relation to other measures.
As a stage in this, the timing of required permissions from authorities will also be clarified.

Decision to develop
Based on the completed pilot project, which will provide the necessary information on the scope of measures and not least costs, it is expected that a final decision on the development of Terminal 2 will be available at the turn of the year 2009/2010.

7 APPENDICES

1. Study programme for Terminal 2. Consequences of measure/ Changes to zoning plan. Approved by Ullensaker municipality, 31 March 2008.
2. Report K-43145 General plan for water management – Summary of sub-report. OSL - COWI. Date 10 June 2008.
3. Impact assessment of the condition of the Sogna and Leira rivers as a result of developing Terminal 2 at Oslo Airport. Undertaken by Aquateam – Norsk vannteknologisk senter AS. Date 25 September 2008.
4. OSL Terminal 2. Parking and public transport share.
   Prepared by the Institute of Transport Economics (TØI) Date Date 4 July 2008, revised Oct. 2008
5. OSL Terminal 2. Sub-report on regional/local feeder traffic, transport network, parking and works traffic.
   Prepared by Øvre Romerike Prosjektering AS. Dated 1 December 2008, revised April 2009.
6. Zoning plan for new main airport at Gardermoen, including provisions.
   Approved 4 June 1993, revised 12 June 1995.

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- The Gardermoen project – Combined presentation of: Main plans for airport and feeder transport system, Consequences for nature, environment and society, Consequences for the armed forces. Dec. 1991.
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- National political guidelines for planning in connection with main airport at Gardermoen - 18 March 1994 (replaces previous NPG from Jan. 1991)
- Programme for enviornmental follow-up. OSL Oct. 1993.
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- Municipal plan for Ullensaker, approved 16 June 2008 and 2 March 2009.
- County sub-plan: Regional development plan for Romerike 2002-2025 – Romerike meets the future (2004)
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- Proposal for National Transport Plan 2010-2019 (Jan. 2008)
- Report to the Storting no. 16 – National Transport Plan 2010-2019 (13 March 2009)
- Transport to and from Oslo Airport from a long-term perspective. TØI 2007.
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- Aviation – sustainability and social benefit. Summary of project report. Avinor et.al. 2008
- Calculations of air quality at Oslo Airport Gardermoen. NILU - 2001
- Calculations of air quality at Oslo Airport Gardermoen. Surveying for T2 impact assessment. Prepared by OSL's safety and environmental staff, based on study performed by KS Environmental Sciences, Inc. USA. Date 26 January 2009.
- Noise zone calculations in accordance with T-1277 for 2002 and 2020.
- Airport plan 2001. Traffic projections for Oslo Airport 2001-2030. OSL 2001.
- Restriction plan for Oslo Airport Gardermoen, laid down by Ministry of Transport and Communications 1998.
- Land conservation plan – proposal submitted to Directorate for Cultural Heritage Feb. 2009
- OSL's Management and administration system, Safety and environmental management plan, etc.
- OSL’s Design Manual.
- Universal design – Guideline for public buildings. Ullensaker municipality 2007.
- Quality plan for entire air journey. Forum for accessibility to air travel.