

WinterPlan and AutoPlan

Executive summary

WinterPlan uses Geographical Information System (GIS) data on road networks as a framework for planning all aspects of snow and ice treatments. Road network information such as speed limits and road width, as well as information relating to trucks and equipment such as application rates and speeds, material used, and distance or time travelled on individual routes may be entered. When this information is combined with GIS data, it provides a reliable, easy to visualize, but data driven basis for optimizing and economizing snow and ice operations. GIS data may be in ESRI, Mapinfo or a compatible format.

AutoPlan takes the data collected in WinterPlan and applies a sophisticated, multivariable analysis to provide suggestions for routes that guarantee the most efficient use of resources. AutoPlan can quickly generate sets of suggested routes for different circumstances so that the level of preparation is consistent, even with unusual weather conditions or rare shortages of drivers or trucks. Due to the tight integration with WinterPlan, planners can alternate between automated and manual planning to guarantee that segments of road that require special treatment are handled properly. No other automated planning utility on the market has this capability.

Introduction

WinterPlan and AutoPlan are software planning tools for winter road maintenance. The programs represent one module in the Winter Road Management System or WRMS suite of products. This module can be used independently or together with additional modules for crew call-outs, job reporting and follow up. WinterPlan will provide you with a proven, data driven basis for streamlining routing. Importantly, AutoPlan and WinterPlan allow you to integrate the on the road experience of drivers and managers into the route planning and automated optimized environment. The goals of WinterPlan and AutoPlan are to:

- plan maintenance operations for different types of actions in user defined planning areas
- allocate resources for most efficient utilization
- document your plans
- reduce costs through improved utilization of resources whilst minimizing travel time
- provide a basis for analyzing job completion, travel times, and material consumption

Basic concepts

WinterPlan imports existing GIS based road data. Additional road data such as length, width, road names/numbers, speed limits and road class may also be imported, as well as user defined fields. This information can also be entered or modified easily within the application. Detailed information about intersections and roadways, which was not included in your imported road network data may be added and edited manually. The user may define job tracking and material related data, such as drivers, vehicles, material carrying capacity and variables relating to spreading equipment such as application width and rates.

The roadway network is displayed graphically in the application. Within the overall roadway network, the user defines multiple planning areas (these may overlap). WinterPlan keeps track of roads within a planning area that should be treated, roads that may be used for transport purposes, and roads that should not be used at all. In each planning area the user defines any number of actions, i.e. vehicle routes required for different types of winter scenarios. Information relating to job completion times and time constraints for individual road classes can be entered.

For example, with salting, after entering treatment rates and the spreading width of your equipment, WinterPlan automatically calculates the number of passes vehicles would need to cover each road segment based on the width of the road and the spreading width of the equipment. With data on driving speeds, speed limits, and material capacity, WinterPlan calculates the time required to cover a set of routes based on the number of vehicles and the amount of material used. This route data may also be manually modified.

Schematic maps

All planning in WinterPlan is carried out using schematic maps. This provides a natural interface to the planning process by graphically showing driving directions and the number of times road segments need to be serviced. By clicking on various color coded flags or handles, detailed information can be recorded about individual road segments, while color coding provides a quick key to road types and surfaces. To better access information in tight road networks, the road network may be stretched and untangled, as in a subway map, without effecting the underlying distances used to calculate times and material used in the planning.

Manual planning

Manual route planning is easy and quick in WinterPlan. Define a route by clicking on road segments in the order they should be driven. Routes can be broken up at any point in order to insert or remove segments. Each route is shown in a colour of your choice. Active route parts (segments that are treated) are shown as solid lines, while transport parts (segments on which the vehicle travels without working) are shown as dotted lines. Detailed highway interchanges with ramps can be expanded to show fine detail so that intersections, ramps, and turnarounds are properly treated. These ramps and intersections are shown as single objects in overview maps. Background layers can also be displayed to provide a better point of reference.

Information on the route (such as length, calculated time and material consumption, comparisons between active and travel segments, etc.) can be shown in a status window while you work on the route. The time calculations take into account speed limits, turning times, and vehicle speed when plowing or applying material, or using a section for transport. Furthermore, the user can define corrective factors based on experience for individual road segments to better account for exceptions such as bus stops and parking areas along a road. This allows for fine tuning of time predictions. WinterPlan can also check your route plan for missed or duplicated road segments.

Reports, Driving directions, and Data presentation

When a set of routes has been constructed, reports, maps, and charts to present the information can be viewed and printed. Step by step driving directions may be printed, with or without an accompanying map. Summaries of distance, time and material consumption are shown in charts, allowing you to review and check planning for optimal resource utilization. The charts show you the proportion in the routes that are used for actual treatment, and indicate if time or material capacity limits are exceeded. You can customize the appearance of the schematic map and print it. You may print color overview maps of the routes in the roadway network, or detailed maps of specific routes in detail, with labels showing the sequence of the route parts.

AutoPlan

AutoPlan is an automated planning module, fully integrated into WinterPlan. AutoPlan uses state-of-the art optimization algorithms for producing high quality routes. Unlike most automated routing software, it works with "arc-routing" (the road segments are "arcs" in this context) rather than "node routing" which is used in e.g. pick-up and delivery operations. Furthermore, AutoPlan is specifically designed to meet the challenging requirements of winter road maintenance applications.

AutoPlan uses the same definitions as manual planning, and a generated route is no different than a manually designed one. You can thus modify automatically generated routes to suit specific conditions and requirements. When an area is selected for automatic planning, the AutoPlan can designate a number of existing routes to be fixed, so that the generated routes cover only those parts of the roadway network that remain. This iterative planning strategy provides a powerful advantage by allowing the user to tweak and perfect automatically planned routes.

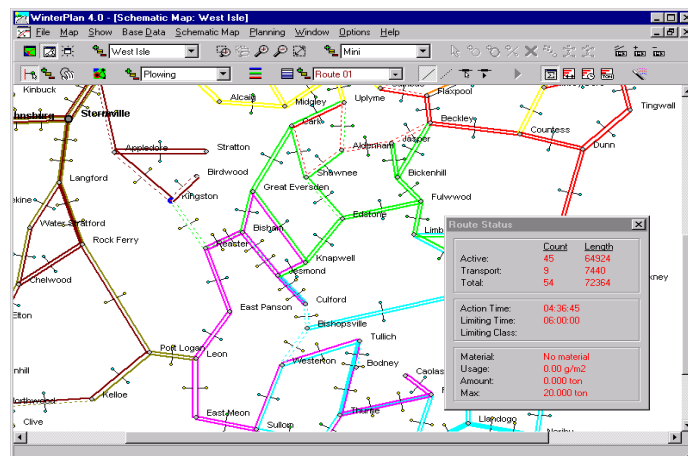
Information on system options

WinterPlan Basic (WRMS-WP)

Includes the functionality to:

- manually set up or supplement GIS based roadway networks
- display the roadway network on a background map
- define a planning area graphically based on road attributes
- set up base data, including drivers, vehicles, equipment, materials, etc.
- define different types of actions for a planning area
- plan routes in a schematic map
- adjust the schematic map to improve readability
- during planning view length and forecast completion time and expected material consumption for routes
- display charts showing distance, time or material consumption data for a selection of routes in an operation
- check that all specified parts of an area are covered by the routes in an operation
- eliminate duplicated road sections from planning
- print detailed route reports
- work on several planning areas simultaneously
- print base maps and data reports

Requirement: WinterPlan Import or WinterPlan Customized Import



Screenshot: WinterPlan Basic

AutoPlan (WRMS-AUT)

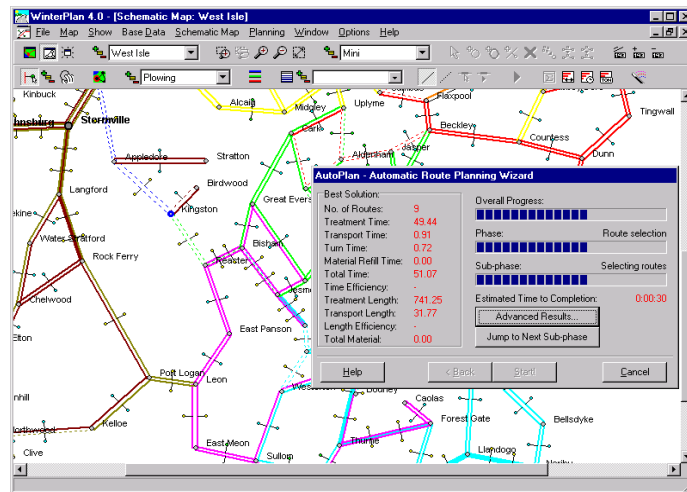
Includes the functionality to:

- automatically construct a set of high quality routes which accurately covers the parts of the road network that you specify
- show graphically the generated solutions during the planning process
- show detailed statistics on the best generated solution

Requirement: WinterPlan Basic

AutoPlan works with the objective of minimizing the non-productive time spent in driving routes (turning, or traveling without treating,) and if desired also the number of routes. AutoPlan can also take into account a variety of important operational situations and constraints, such as:

- different vehicle types, speeds, and material capacity
- number and location of vehicle depots
- speed or time adjustments for individual road segments
- turn times and turn restrictions
- targeted completion times for different road classes
- minimum and maximum number of routes for each combination of depot/vehicle type
- overall minimum number of routes/vehicles required for a given targeted completion time
- special considerations for roads based on width, or roads used only for transport



Screenshot: AutoPlan

