THE EVALUATION OF ECO-COMPATIBILITY PROJECTS EXPECTED WITHIN THE STRATEGIC ENVIRONMENTAL ASSESSMENT OF THE XX OLYMPIC WINTER GAMES TORINO 2006

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1 SUMMARY

The Organising Committee (TOROC) is committed to organise the XX Olympic and IX Paralympic Winter Games according to the principles of environmental sustainability, as a consequence of the recommendations issued on the basis of the Strategic Environmental Assessment (SEA).

The Olympic Winter Games Torino 2006 represent the first case in Italy - and one of the first in Europe - of the application of the SEA: a tool aimed at evaluating the ecocompatibility of plans and programmes before these become executive.

The paper deals with some activities, in charge of the Environmental Department expected within the SEA aimed at assessing the ecocompatibility of permanent venues, facing the issues of design and construction phases and their environmental effects.

The above mentioned activities have been carried out through the development of the following tools, described in the paper:

- Guidelines for project sustainability as regards the construction and management of Olympic and Multimedia Villages;
- System aimed at evaluating the Eco-compatibility Projects within the Quality Settlement Indicator as provided in the Monitoring Plan foreseen by the SEA.

Such system, highlighted in the paper, is subdivided into performance indicators, methodologies and assessment criteria developed in cooperation with Piedmont Region and transferred for the operative assessment to Polytechnic University of Turin. Pictures concerning the representation of results carried out throughout a Geographic Information System (GIS) are also included.
More than a century has passed since the first edition of the modern Olympic Games (Paris, 1894). During that time, many changes have been made to the policies of the International Olympic Committee (IOC). Over the last ten years environmental protection has become an increasingly important issue for the Olympic Movement and the environment is now the third dimension of the Olympic Games, alongside sport and culture.

The work of the Organising Committee for the XX Olympic Winter Games – Torino 2006 (TOROC), and of its Environment Department, is based on a number of political-strategic commitments and legal requirements.

The former constitute the foundations for initiatives such as the Green Card, presented during the bidding phase, the Olympic Movement’s Agenda 21, adopted by the IOC in 1999, and the Charter of Intent whereby, in 2002, the TOROC ratified the IOC’s Code of Ethics.

The latter have led to the implementation of the Strategic Environmental Assessment process to evaluate the impact of the Olympic programme.

These are some of the reasons why Torino was selected to host the XX Olympic Winter Games. They reflect the aim of leaving a positive legacy, not only during the two weeks of competitions, when the world’s attention will be focussed on the Olympic sites, but also before and after the event.

### 2.1 The Environmental Mission

TOROC is a private, non-profit foundation responsible for organising the Olympic Games, including the sporting events and the Opening and Closing Ceremonies, for managing the Olympic Villages hosting the athletes and technicians, the Press Village, the Press and International Broadcasting Centres, and for providing television and radio services. It will have the task of coordinating the activities of the Olympic Programme in order to guarantee that the deadlines for planning and completing the works are respected. The Committee will also coordinate transport and medical services, set up the temporary structures necessary for athletes and spectators, plan and promote the cultural programme, and arrange accommodation and transport for the athletes, technicians, sports staff, media and personnel involved in the events. Lastly, it will prepare a Marketing Programme in collaboration with the IOC and CONI (the Italian National Olympic Committee).

The Olympic and Paralympic Games will leave many tangible and intangible sign on the area where they are hosted, and TOROC, being aware of the public responsibility of its mission, has implemented a wide range of innovative measures and initiatives aimed at building a valuable Olympic heritage for the area.

Tangible examples of this commitment are the *environmental programme* which defines the basic ethical, social and environmental code of conduct that TOROC intends to follow whilst carrying out its tasks.

### 3 AREAS FOR THE EVENTS

The Olympic Programme requires a wide range of initiatives to be organised by TOROC and the local institutions and communities, aimed at running the Games, adapting the functionality
and accessibility of the Territory, and developing the sporting and tourist facilities for the Games as well as for their longer-term use.

All of the sport and training facilities, the operational and logistical centres and the reception structures are being developed in two local sub-systems; that in the metropolitan sites (Torino – see figure 1 -, Pinerolo and Torre Pellice) and that in the mountains where the venues for the high-altitude events are located (the Susa, Chisone and Germanasca Valleys and Sestriere, Bardonecchia, Cesana, Pragelato and Sauxe d’Oulx Districts, including the training sites at Claviere, Prali and Chiomonte).

Figure 1. Map of the Olympic Layout in Torino.

4 THE STRATEGIC ENVIRONMENTAL ASSESSMENT

The Torino 2006 Olympic programme represents the first case in Italy - and one of the first in Europe - of the use of the Strategic Environmental Assessment (SEA) process, a tool aimed at evaluating the sustainability of plans and programmes in a specific geographic area before these become executive.

Pursuant to Law No. 285 of October 9, 2000, “Works for the Olympic Winter Games - Torino 2006”, the SEA process included submitting the Olympic programme to an “environmental compatibility study”. At the beginning of 2001 the TOROC presented the results of this study to the Piedmont Region for approval, in accordance with the above-mentioned law. After consultation with the Ministry for the Environment and Territory, the Piedmont Region passed resolution No. 45-2741 of April 9, 2001 recognising the compatibility and “overall sustainability” of the Olympic programme, subject to observance of a series of recommendations regarding technical aspects, procedures and programmes aimed at further improving the environmental performance of the programme.
These recommendations, together with the actions aimed at protecting the environment that were outlined in the results of the study presented to the Region, constitute the framework for the environmental activities of those involved in staging the Games, namely:

- The TOROC, as the body responsible for organising the event pursuant to the contract with the International Olympic Committee;
- The Agenzia Torino 2006, as the state-funded organisation responsible for awarding contracts to design and construct the infrastructures and facilities specified in Law 285/00 that are needed to stage the competitions;

Piedmont Region, Province and City of Torino and the Regional Environmental Protection Agency - ARPA) plays a fundamental role in evaluating and monitoring the environmental compatibility of Olympic works and must also work with the TOROC to implement actions and environmental programmes to guarantee sustainability even after the Olympic Games.

Within the framework of the SEA process, the TOROC was required to define a set of general planning tools to be used by the Agenzia Torino 2006 in the various stages of construction works. These Strategic Plans address the following issues:

- Inert waste from excavations and worksites;
- Sustainable mobility;
- Safety of workers and local inhabitants (defined in conjunction with the Piedmont Region and the Health Department, in agreement with all the parties concerned);
- Water management (defined directly in conjunction with the Province of Torino);
- Prevention of natural risks;
- Environment and landscape.

Furthermore, on its own initiative, the TOROC defined:

- The Guidelines for project sustainability as regards the construction and management of Olympic and Multimedia Villages;

These tools, and the others developed by TOROC, are proving to be highly effective in guiding the choice of projects and creating close synergies among those involved in the Olympic programme.

Relating to the guidelines for the sustainability of Olympic Villages: the Agenzia Torino 2006 included these in the competition to design the Olympic Village on the site of the former wholesale market and they represented the core criteria in the appraisal and selection of the winning project, which is characterised by the widespread use of sustainable architecture and the rational use of energy.

5 GUIDELINES FOR PROJECT SUSTAINABILITY AS REGARDS THE CONSTRUCTION AND MANAGEMENT OF OLYMPIC AND MULTIMEDIA VILLAGES

The Guidelines can be assumed as an overall strategic tools concerning a design approach aimed at guaranteeing the sustainability of Villages in their entire life cycle.

The guidelines provide information on materials, technologies and techniques for an environmental conscious design.

Within the manual are available references on methodological tools that can be assumed in order to assess if the design options are coherent with an environmental approach.
The correlation between sustainability and design process means that architects and building contractors have to relate their activities to several items connected on multidisciplinary knowledge. At this aim the guidelines have been organised in different topics related to: use of local climate resources, environmental quality of outdoor spaces, relations with urban areas, reduction of resources consumption and pollutants, indoor air quality and maintenance.

Regarding the assessment tools, they contemplate: drawings, lighting, thermal and acoustic technique calculations, labelled materials, outcoming of laboratory tests and the monitoring activities.

The Agenzia Torino 2006 has acknowledged the guidelines contents in the Preliminary Design Reports (PDR). Within those reports are established requirements aimed at realizing sustainable architectures and sustainable urban settlements.

With reference to the environmental performance indicators foreseen in the guidelines, the projects were developed by taking into account:

- surface temperature of exposed facades to solar radiation;
- exposure to winter prevalent winds;
- usage of energy efficient equipments;
- usage of photovoltaic and solar collectors;
- recovering of rain and grey water;
- usage of materials requiring low energy consumption and a reduction of pollutant emissions;
- environmental load due to construction phase - Construction and Demolition (C&D) waste and acoustic, atmospheric and water emissions;
- quality of natural and artificial internal lighting;
- protection against atmospheric and acoustic pollution;
- thermohigrometrical comfort and the best level of indoor air quality;

Architects had to define since the preliminary design the specific sustainable objects to reach and, as consequence, the related requirements, detailing the:

- qualitative project requirements;
- quantitative projects requirements;
- technology and material solutions aimed at testing the above mentioned requirements.

6 THE ENVIRONMENTAL MONITORING PLAN FOR THE OLYMPIC GAMES TERRITORY

On the basis of the findings of the SEA process and as agreed upon with the Piedmont Region and the Ministry for the Environment, the TOROC is managing the environmental monitoring plan in the areas affected by the Games.

During the development of the Olympic Programme, TOROC must guarantee a overall positive environmental balance sheet, through the continuous monitoring for achieving the above mentioned environmental objectives by means of specific indicators to be organised chronologically during the different phases:

- before and during the planning stages;
• during the building stages;
• during the testing stages;
• during the event;
• after the event.

The Environmental Monitoring Plan, already launched by TOROC, must take into account, and must interface with, the existing monitoring activities carried out in the relevant territory by the Piedmont Region, the Province of Turin and ARPA according to their organisational tasks, and each phase must be followed up with the compilation of an environmental balance sheet together with a verification of progress versus targets, from which indicators for effectively reaching the objectives can be derived.

The SEA has identified the Monitoring Plan as the instrument that provides, on the one hand, a constant updating of the state of the environment useful to orienting the Olympic Programme planning process, with the purpose of guaranteeing, through subsequent fine-tuning, an overall positive environmental balance sheet, and on the other hand makes sure that the predefined goals are punctually achieved.

The Environmental Monitoring Plan is based on a set of 16 indicators, defined in agreement with the Regional Authorities of Piedmont and the national Ministry of the Environment, which makes it possible to assess the overall changes to the state of the environment at any time during the implementation of the Olympic Programme. This set was published by the Piedmont Region in the 2nd supplement to BURP no. 37, dated 12 September 2001, and consists of sixteen indicators related to the following thematic areas:

• Water system,
• Air quality,
• Soil use,
• Energy consumption,
• Waste production,
• Ecosystems,
• Landscape,
• The urban and topological quality.

The methodology for calculating and assessing the indicators was developed by TOROC in cooperation with the Piedmont Regional Environmental Protection Agency (REPA) and was shared with Piedmont Region and the national Ministry for the Environment.

The indicators are quantified and characterised periodically in order to achieve the following objectives:

• assessing and monitoring the environmental impacts (positive and negative) of the organisational process;
• guarantee, at the end of the Games, overall sustainability for the environment and the area.

The Strategic Environmental Assessment procedure requires that the direct and indirect, cumulative, synergistic, short-term and long-term, permanent and temporary, and positive and negative effects on the territory are assessed, for the purpose of verifying the environmental sustainability of the Torino 2006 Olympic Winter Games works plan.
6.1 The Environmental Monitoring of the urban and topological quality

The SEA provides the following key factor aimed at assessing the environmental quality settlement:

- Urban renovation (reclaiming of neglected spaces in urban area);
- Topological renovation (improvement of mountain areas through naturalizations and hydrological adjustment);
- Building Renovation (restoration work on obsolete constructions and technological reclaiming of existing infrastructure);
- Activities allocation foreseen within the Olympic Programme;
- Reclaiming of road network;
- Bio-architectonic techniques used in constructions;
- Building ecocompatibility and potential pollution of materials used for infrastructures.

Concerning the environmental sustainability of building design the above mentioned thematic areas affecting the sixteen indicators were related to a methodology detailed in the Peretti-Grosso’s paper. A large part of the Italian National Standard approach sustainability requirements described in the paper were assumed as a reference. Thus Torino Olympic Village was chosen as one of the representative case studies to validate the methodology developed.

The evaluation of the performance scheme of a building project is carried out on the basis of pre-defined classes of performance values to be applied to the indicator/s related to each requirement. The number of classes is 6, ranging from 0 to 5.

These ranges of classes of values, i.e., environmental performance scores, are related to predefined benchmark qualities defined as follows:

- baseline benchmark (score 0/5) – related to current practice and regulation standards;
- best practice benchmark – related to the best environment-conscious practice in the local context (score 3/5);
- optimum target benchmark (score 5/5) – the highest possible target performance values compatible to the local technology state of the art as well as social acceptability and economic conditions.

The Table 1 shows the sustainability assessment for a requirement assumed as example. The requirement is linked to a qualitative or quantitative check system. Furthermore the environmental performance score is also included.
Table 1. Check system and range of classes assumed as reference for assessing the winter solar radiation control requirement.

<table>
<thead>
<tr>
<th>MONITORING PLAN FOR THE OLYMPIC GAMES TERRITORY</th>
<th>Turin – Olympic Village Lot 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>REQUIREMENT</td>
<td>Winter Solar Radiation Control</td>
</tr>
<tr>
<td>GENERAL OBJECTIVE</td>
<td>Use of Climate Resources</td>
</tr>
<tr>
<td>LIFE CYCLE PHASE</td>
<td>Use phase</td>
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<tr>
<td>ASSESSMENT</td>
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<tr>
<td>Check System</td>
<td>Quantitative</td>
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<td></td>
<td>e = solar form efficiency</td>
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<td></td>
<td>Asol = area of windows located on south facade</td>
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<td></td>
<td>Atot = total windows area</td>
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<td></td>
<td>e = Asol/Atot</td>
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<tr>
<td></td>
<td>Qualitative</td>
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<td>Range of classes</td>
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<tr>
<td>0</td>
<td>e &lt; 0.1</td>
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<td>1</td>
<td>0.1 &lt;= e &lt; 0.2</td>
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<tr>
<td>2</td>
<td>0.2 &lt;= e &lt; 0.3</td>
</tr>
<tr>
<td>3</td>
<td>0.3 &lt;= e &lt; 0.4</td>
</tr>
<tr>
<td>4</td>
<td>0.4 &lt;= e &lt; 0.5</td>
</tr>
<tr>
<td>5</td>
<td>e &gt; 0.5</td>
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</tbody>
</table>

The check system has been carried out for the Olympic Village buildings. A schematic plan referred on a lot of the Village shows the value obtained for each building while the overall assessment has been calculate as an weighed average. (see figure 2).

Figure 2. Schematic plan of performance values of buildings for an Olympic Village lot. On the left the score based upon the weighed assessment of overall site area. (Requirement: Winter Solar Radiation Control)
A Geographic Informative System has been implemented in order to carry out an analysis of the information collected for the environmental monitoring. Such tool allows to link for each information gathered about urban and mountain area an appropriate geographical coordinates. This data processing determine the state of environment in spatial and chronological terms. In order to have a clear conception of the activities carried out, it is important to highlight that a GIS software is suitable to:

- Identify for each information collected the relevant area of influence;
- Process query to submit to database selected.

Concerning the environmental monitoring foreseen within the XX Olympic Winter Games the database is characterized by specific key factors linked on each of sixteen indicator above mentioned. Such key factors are very different in term of contents, chronological updating and units. This is the reason why the geographical reference system adopted has become the standardising factor. Moreover a geographical data analysis allows to check:

- The development trend for every key factor in a time period;
- The relationship with other correlate key factors in a boundary area.

Crucial in the geographical analysis was to make use of an proper reference scale related to data processed. Concerning TOROC Monitoring Plan the cartographical support assumed as reference is the Regional Technical Map, scale: 1:10.000. Such rate scale is due to the assessment of Indicators significance, mainly measurable on territorial map. Aerial-photographs are periodically provided and included as cartographical support within the GIS system developed. These aerial-photographs check year by year - the topological changing within the Olympic Programme.

The database is developed through SQL SERVER and the data entry has been carried out as follows:

- “direct data” – through measurement tools placed on mountain and urban areas;
- “indirect data” – through database provided by public authorities.

Such data are filled in a specific format aimed at working with different interfaces (i.e. excel and access database) thus no further data processing are required. (see figure 3)
Concerning the key factors affecting the settlement quality assessment they can not be monitored only through the Regional Technical Map. According to goals of the research activity was required a different rate scale.

In urban areas the Turin Technical Map (scale: 1:1000) was the suitable choice, instead for extra urban and mountain areas, in consideration that the information analysis is not oriented on buildings but on wider areas, was adopted a cartographical support provided by the Province of Turin with a 1:5000 rate scale.

For both cases the key factors were assessed through:

- A graphic work organized into several layers, where the project files were georeferred;
- A database where layers were characterised.

The figure 3 shows a thematic map drafted by GIS technology based upon the developed database for one of the urban area considered.

Concerning the mountain area the comparison of key factors carried out through GIS system allows to demonstrate some critical state - i.e. number of daily vehicles measured as average each year- that public authorities could take into account in order to control road traffic and gathering the main objectives defined within the SEA procedure. The figure 4 shows the GIS map relating to a road bypass on Torino – Sestriere SS 23 road . The data collection of number of vehicles on the SS 23 road was an useful support to allocate the proper place where the road Bypass could be realised as it shown in figure 5.

*Figure 3. Thematic map related to allocation of activities drafted by GIS technology – Torino Olympic Village.*
Figure 4. Thematic map related to number of vehicles - average daily traffic – measured each year from 2001 to 2003 on SS23 Torino Sestriere.

Figure 5. Project of bypass road on SS23 Torino Sestriere based on GIS analysis and evaluation.
8 CONCLUSION

In conclusion, GIS can be assumed as the most suitable tool aimed at evaluating a huge number of key factors that have to be taken into account within the monitoring plan. Through related database, updated constantly, each changing at topological and urban scale can be assessed and displayed with suitable thematic maps. Furthermore both graphics and database works are the results of an agreement with Public Authorities that at the end of the games time will be the final users of the GIS system. Thus such system will be implemented in order to provide strategic information for town and territorial planning activities.

9 REFERENCES


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