



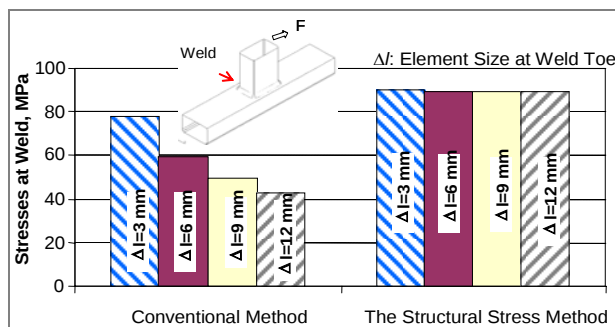
Battelle
The Business of Innovation



A Unique Course Series Offered for the First Time in Europe!

The Mesh-Insensitive Structural Stress Method for Fatigue Evaluation of Welded Structures

July 11-12, 2007
Bureau Veritas, Paris, France



Battelle Structural Stress (BSS) Method

A Battelle Joint Industry Project (JIP) was launched in 2001 to further refine and validate the Battelle mesh-insensitive structural stress (BSS) method (its commercial version is also referred to as the Verity® module in fe-safe™ distributed by Safe Technology). Since then, the structural stress method has not only been proven to be mesh-insensitive and robust, but has also been demonstrated as effective in collapsing thousands of well-documented fatigue tests from the literature into a single narrow band, referred to as the master S-N curve. One major objective in the on-going JIP is to facilitate the adoption of the BSS method by various Codes and Standards. As such, Bureau Veritas (BV) is currently leading the development of fatigue guidance incorporating the BSS method for use in offshore/marine structures. Another recent milestone along this line is the adoption of the BSS method by the new 2007 ASME Div 2 and API 579/ASME FFS-1 Codes to be published in the summer of 2007.

As a part of the on-going Battelle JIP activities, an entry-level training course on the Battelle structural stress methodology is offered twice a year for both JIP II sponsors (free of charge for up to five representatives per sponsor) and non-JIP participants.

About the Course

This course will provide a unique opportunity for attendees to learn the details of the mesh-insensitive structural stress method for fatigue evaluation of welded structures, from its mechanics basis, numerical implementation to S-N data correlations and life predictions. Through this training course, participants will become familiar with some of the most important issues associated with fatigue of welded joints and existing design and analysis methods. Participants, with hands-on experiences gained during the training course, should be able to:

- Solve basic fatigue design problems
- Effectively interpret fatigue test data
- Perform computer-based fatigue life estimations for small-scale fatigue problems

A demo version of an automated structural stress post-processor and a bound volume of all course notes will be provided to all registered participants. It is desirable to have a laptop for effective participation in the hands-on exercises.

Course Instructor

The course will be taught by Dr. P. Dong, the lead developer of the mesh-insensitive structural stress method. He has published over 180 peer-reviewed papers in archive journals and major conference proceedings and lectured internationally as a keynote or invited speaker on fatigue/fracture of welded structures and advanced computational modeling techniques for welding/joining processes. Dr. Dong has received numerous prestigious awards/recognitions, including *R&D Magazine's* R&D 100 Award (2006), *TIME Magazine's* Math Innovator (2005), *Aviation Week and Space Technology's* Aerospace Laurels Award (2004), AWS's R.D. Thomas (2004) and Dr. R. Wasserman Awards (1998), SAE's Henry Ford II Distinguished Award for Excellence in Automotive Engineering (2003), ASME G.E.O Widener Literature Award (2002).

Course Content

Weds July 11, 2007, 9am-6pm:

1. Fundamental aspects of weld fatigue

- Some relevant terminologies and definitions
- Unique fatigue features associated with welded joints
- Conventional fatigue evaluation procedures
 - Key assumptions
 - Stress definitions and calculation procedures
 - Code-recommended S-N curves and assumptions
 - Unresolved critical issues

2. The Structural Stress (SS) Method – Part I

- Requirements for an effective fatigue parameter
- The structural stress definition
 - Weld toe and weld root failure modes
 - Mechanics basis
 - Numerical implementation
- Simple calculation procedures
 - Shell/plate models
 - 2D and axisymmetric solid models
- SS measurement techniques and validations
- Comparison with other stress definitions
 - ASME stress classification method
 - Hot spot stress method, etc.

3. The Structural Stress Method – Part II

- Needs for a generalized SS procedure
- SS procedure for arbitrarily curved weld in space
- Formulation and numerical implementation
- Mesh-insensitivity validations
- Treatment of multi-axial stress state
- Structural stress post-processor
- Demo of SS Post-Processors
- Hands-on session by course participants with pre-prepared examples run on their laptops

Thurs July 12 2007, 9am-12pm

4. The Master S-N Curve Approach

- How to consider thickness and loading mode effects?
 - Fracture mechanics consideration
 - SS-based K solution techniques
 - Two-stage crack growth model and validations
- Formulation of the master S-N curve
- Validations using a large amount of S-N data
- Implications on fatigue testing and data interpretation
 - Failure definitions
 - Load-controlled versus displacement-controlled

5. SS Modeling and Fatigue Prediction Procedures

- Structural stress calculations – do's and don'ts
- Other weld types, e.g., spot welds, friction stir welds, etc
- Treatment of weld root/throat failure
- Life prediction examples

6. Additional Applications

- Multi-axial and non-proportional loading
- Low cycle fatigue and thermal fatigue
- Solder fatigue in electronic packaging
- Highlights of the master S-N curve procedure in the new 2007 ASME Div 2 and API 579/ASME FFS-1
- Battelle SS method in BV's VeriStar and applications for fatigue evaluation of a full FPSO
- Demo of Verity™ in fe-safe™

7. Summary and Q/A



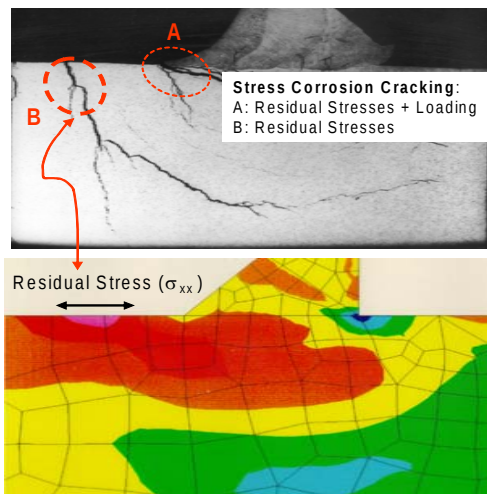
Battelle
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A Unique Course Series Offered for the First Time in Europe!

Residual Stresses and Distortions in Welded Structures: Modeling, Analysis, and Mitigation

July 12-13, 2007
Bureau Veritas, Paris, France



Example: Root Cause Analysis for a Real-World Stress Corrosion Cracking

About the Course

It is well known that welding-induced residual stresses and distortions can have significant impact on the manufacturability and structural integrity of welded components. This unique course is designed to:

- provide a critical assessment of the “state of art” residual stress modeling, analysis, and measurement techniques
- demonstrate effective modeling and analysis procedures for various industrial applications
- train participants to define and solve day to day residual stress and distortion problems, e.g., how to effectively:

- obtain engineering solutions using existing commercially available analysis techniques
- mitigate residual stresses and distortions
- incorporate residual stresses in fracture and fatigue assessment procedures

A bound volume of all course notes will be provided to all registered participants.

Course Instructor

The course will be taught by Dr. Pingsha Dong of Battelle, who has published over 180 peer-reviewed papers in archive journals and major conference proceedings. He has lectured internationally as a keynote or invited speaker on fatigue/fracture of welded structures and advanced process computational modeling techniques for welding/joining processes. He has received numerous prestigious awards/recognitions, including *R&D Magazine*’s R&D 100 Award (2006), *TIME Magazine*’s Math Innovator (2005), *Aviation Week and Space Technology*’s Aerospace Laurels Award (2004), AWS’s R.D. Thomas (2004) and Dr. R. Wasserman Awards (1998), SAE’s Henry Ford II Distinguished Award for Excellence in Automotive Engineering (2003), ASME G.E.O Widener Literature Award (2002).

Course Content

Thurs July 12 1pm – 6pm

- Why should we be interested in residual stresses?
 - Weldability
 - Structural manufacturability
 - Structural integrity
- Residual stress/distortion development mechanisms
 - Necessary and sufficient conditions
 - Thermal stress
 - Simple thermo-plasticity descriptions for welding processes
 - A graphic solution technique for a simple 1D, but important residual stress problem
 - Some typical weld residual stress distributions and their implications
- Modeling requirements and procedures
 - Time and length scale considerations
 - What needs to be modeled?
 - What can be modeled today?
 - How to validate modeling results?
 - Proven residual stress analysis procedures
 - Welding heat flow solutions
 - 2D versus 3D simulation
 - The most common mistake in 2D analysis
 - High temperature material behavior
 - Proper constitutive model descriptions
 - What need to be considered?

What can be ignored?

- Proven distortion analysis procedures
 - Stable distortions
 - Unstable or buckling distortions
- Residual stresses in weld repairs

Fri July 13 9am – 5pm

- Comments on residual stress measurements
 - Available techniques
 - Assumptions and limitations
 - Why measurements can be wrong!
 - How to interpret measurement results
 - How to devise an effective measurement plan
 - Some well-documented examples
- Comments on residual stresses from other welding/joining processes
 - High energy beam processes (EB, Laser, etc)
 - Solid state processes, e.g., RSW, friction/inertia welding, friction stir welding, etc
- Principles for mitigating residual stresses and distortions
 - In-process techniques, e.g., thermal and/or mechanical conditioning techniques, weld sequencing planning, fixturing, etc.
 - Post-process techniques, e.g., thermal and/or mechanical based stress improvement techniques (e.g., local peening, rolling, ...) and conventional stress relief treatment (PWHT, Local PWHT, alternative stress improvement techniques, hydrotest, etc)
- Some well-documented real-world examples on residual stresses and distortions, and mitigation techniques
 - Aerospace and automotive
 - Petrochemical/power generation
 - Heavy equipment and offshore/marine structures
- Fracture mechanics treatment of residual stresses in fitness for service assessment
 - A length scale based characterization
 - Residual stress decomposition technique
 - A generalized parametric description adopted by the 2007 API 579/ASME FFS-1
 - The problem with J-integral calculation
 - Load- versus displacement-controlled conditions
 - Residual stress contributions to K and effective operative ranges
 - Residual stress induced tri-axiality
 - Treatment of residual stresses in fatigue assessment
 - Some application examples: residual stress and PWHT induced creep damage; stress corrosion cracking evaluation; novel stress improvement techniques
- Summary and Q/A



Registration Form¹

1. The Mesh-Insensitive Structural Stress Method for Fatigue Evaluation of Welded Structures, July 11-12, 2007
2. Residual Stresses and Distortions in Welded Structures: *Modeling, Analysis, and Mitigation*, July 12-13, 2007

Please remit via fax or mail to:

Attendee's Name: _____

Attendee's Title: _____

Company Name: _____ Citizenship: _____

Street Address/P.O. Box _____ City: _____ State: _____

Zip/Postal Code: _____ Country: _____ Office Phone: _____

Office Fax: _____ E-mail address: _____

Ms. Michèle Valbousquet
Bureau Veritas, DR, 5/6 Place de l'IRIS
92095 Paris La Défense Cedex.
Phone: +33142913360
Fax: +33142913395
Email: michele.valbousquet@bureauveritas.com

Course Selection (Please mark those as appropriate)	Registration Fee (Euros) ¹			
	Prior to June 18, 2007		After June 18, 2007	
	On-Going Battelle Structural Stress JIP Participant?			
	Yes	No	Yes	No
Course 1 only	800€	1200€	1200€	1600€
Course 2 only	Free	1200€	Free	1600€
Registration for Both	800€	2000€	1200€	2640€
Total				

Payment : Bank Transfer to :

Account Name : BUREAU VERITAS – 92077 Paris La Défense Cedex – France
Bank : BNP Paribas Le Parvis La Défense, 3 Place de la Défense, 92974 Paris La Défense Cedex - France
Account No : 30004 01328 00010688629 04
IBAN Code : FR 76 3000 4013 2800 0106 8862 904
BIC Code : BNPAFRPPPTX
Ref. BUREAU VERITAS/BATTELLE Courses – July 2007

Local Area Hotels and Maps : See the attached

¹ For registration using major credit cards, please use the alternative registration form on the next page

² 100% of the course fee will be charged for cancellations received after July 1st 2007. We reserve the right to limit admission



Alternative Registration Form (for Using Major Credit Cards)

1. The Mesh-Insensitive Structural Stress Method for Fatigue Evaluation of Welded Structures, July 11-12, 2007
2. Residual Stresses and Distortions in Welded Structures: *Modeling, Analysis, and Mitigation*, July 12-13, 2007

Please remit via fax or mail to:

Attendee's Name: _____

Attendee's Title: _____

Company Name: _____ Citizenship: _____

Street Address/P.O. Box _____ City: _____ State: _____

Zip/Postal Code: _____ Country: _____ Office Phone: _____

Office Fax: _____ E-mail address: _____

Ms. Bonnie Bailey
Battelle, 505 King Avenue
Columbus, OH 43201-2693
Phone: 614-424-4388
Fax: 614-458-4388
Email: Baileyb@battelle.org

Make Checks payable to: **Battelle Memorial Institute**

Course Selection (Please mark those as appropriate)	Registration Fee (USD)*			
	Prior to June 18, 2007		After June 18, 2007	
	On-Going Battelle Structural Stress JIP II Participant?			
	Yes	No	Yes	No
Course 1 only	\$1,000	\$1,500	\$1,500	\$2,000
Course 2 only	Free	\$1,500	Free	\$2,000
Registration for Both	\$1,000	\$2,500	\$1,500	\$3,300
Total				

Amount: _____ (US Currency)

Charge by Credit Card: Charge to: ☐ VISA ☐ MasterCard ☐ American Express

Account Number _____

Exp. Date _____

Signature _____

Date _____

* 100% of the course fee will be charged for cancellations received after July 1. We reserve the right to limit admission

Hotels in La Défense Area

The following four hotels may be booked with Bureau Veritas (BV) negotiated rates only by booking through BV (email: aurelie.douarka@bureauveritas.com, tel : +33 1 42 91 33 61, or fax : +33 1 42 91 33 95). However, availabilities at these hotels cannot be guaranteed due to the high season.

Hotel NOVOTEL (*)**

2, Boulevard de Neuilly

La Défense 1

Paris La Défense Cedex 92081

Tel : 33 1 41 45 23 23

Fax : 33 1 41 45 24 25

(Location : about 10 minutes walk to our office)

Negotiated rate with Bureau Veritas: 151 Euros/Night (single/double), 171 Euros/night during high season (exhibitions...) + 14 Euros for Breakfast)

MERCURE La Défense Esplanade Résidence (*)**

35, Cours Michelet

92060 Paris La Défense cedex

Tel : 33 1 47 73 90 90

Fax : 33 1 47 76 44 36

(Location : about 10 minutes walk to our offices)

Negotiated rate with Bureau Veritas: 109 Euros/Night (standard room), 128 Euros/Night (business room), 14.00 Euros/person for breakfast)

Hotel IBIS ()**

4 Boulevard de Neuilly

La Défense 1

92081 Paris La Défense

Tel : 33 1 41 97 40 40

Fax : 33 1 41 97 40 50

(Location : about 10 minutes walk to our offices, Price per night per room: 119 Euros + 7.00 Euros for breakfast (reservations can be done directly). There is no BV negotiated rate for IBIS)

FraserSuites Harmonie Paris la Défense (**)**

6 Boulevard de Neuilly

La Défense 1

92400 Courbevoie

Tel : 33 1 55 23 26 26

Fax : 33 1 55 23 27 27

(Location : about 10 minutes walk to our offices (next to Novotel and Ibis)

Price per night per apartment: from 119 Euros/night (Studio) + 10.00 Euros for breakfast/person, from 155 Euros/night (One bedroom), from 189 Euros/night (Two bedroom))

OTHER LOCAL AREA HOTELS

SOFITEL Paris La Défense Centre (**)**

34, Cours Michelet – Paris La Défense

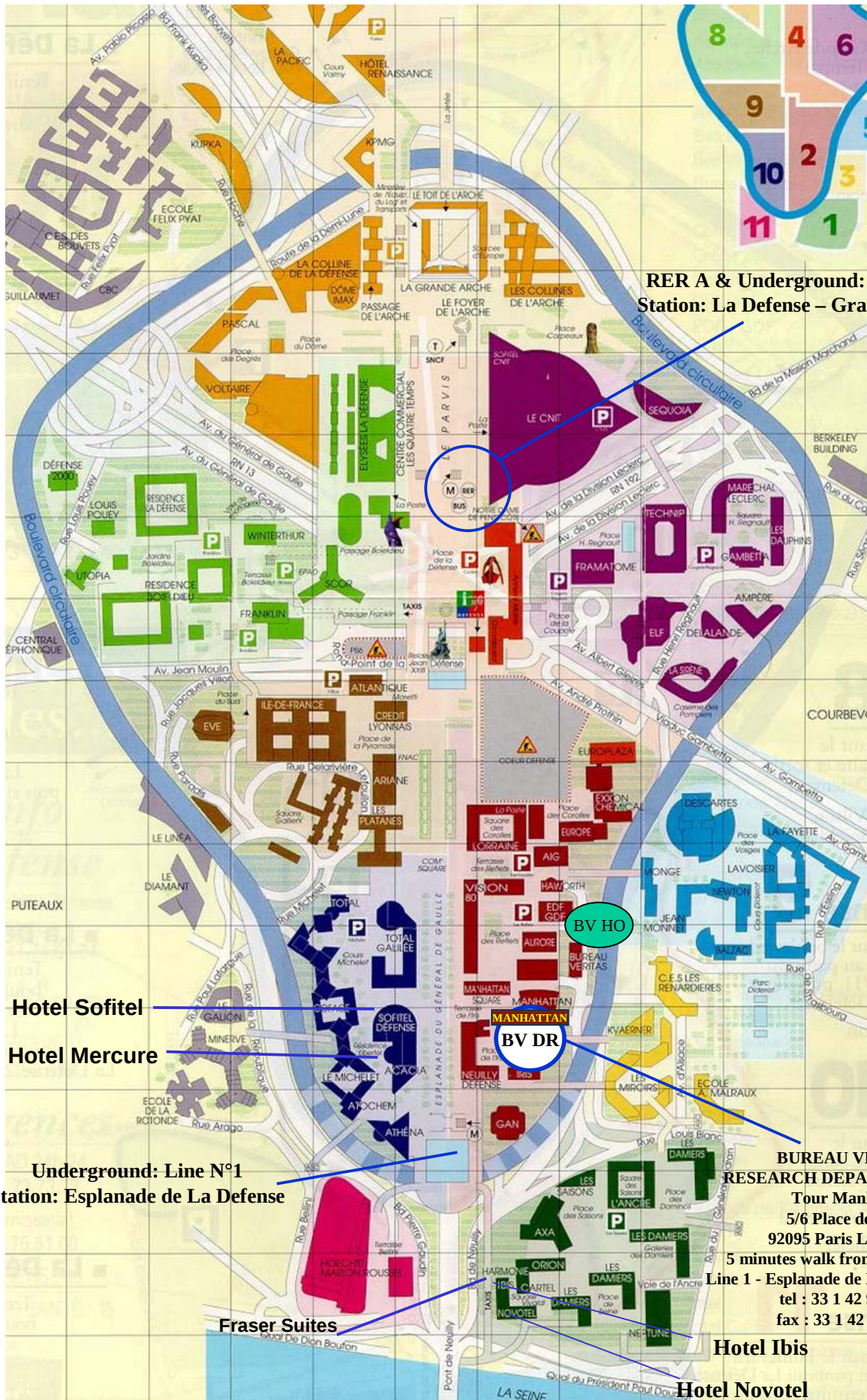
Tel : +33 1 47 76 44 43

Fax : +33 1 47 76 72 10

Hotels in the centre of Paris may be also proposed according availabilities at these dates

For any help for your bookings, please contact :

aurelie.douarka@bureauveritas.com or michele.valbousquet@bureauveritas.com



**RER A & Underground: Line N°1
Station: La Defense – Grande Arche**

Hotel Sofitel

Hotel Mercure

**Underground: Line N°1
Station: Esplanade de La Defense**

Fraser Suites

**BUREAU VERITAS
RESEARCH DEPARTMENT (DR)**

Tour Manhattan

5/6 Place de L'Iris

92095 Paris La Défense

**5 minutes walk from Underground
Line 1 - Esplanade de La Defense station**

tel : 33 1 42 91 33 60

fax : 33 1 42 91 33 95

Hotel Ibis

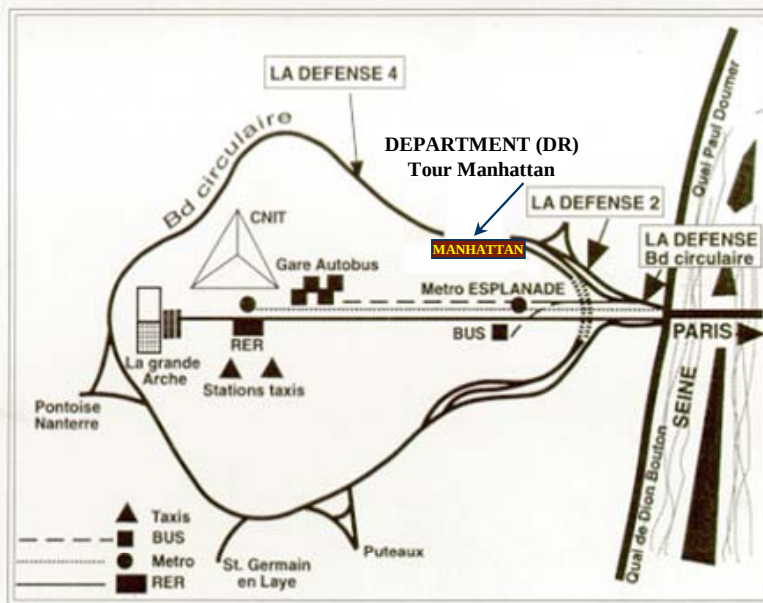
Hotel Novotel



**BUREAU
VERITAS**

Tour Manhattan
5-6 place de l'Iris
Paris La Défense

Adresse postale - Postal address :
92077 PARIS-LA-DEFENSE CEDEX



1. RER

- 1.1. Sortir à la station LA DEFENSE, puis sortie B.
- 1.2. L'accès à l'immeuble BUREAU VERITAS se trouve Place de l'Iris -Tour Manhattan (15 mn à pied)

1. RER

- 1.1 Exit at LA DEFENSE station then follow exit sign "sortie B"
- 1.2 The BUREAU VERITAS building is located Place de l'Iris Tour Manhattan (15 mn walk)

2. METRO

Prendre ligne Château de Vincennes - LA GRANDE ARCHE LA DEFENSE. Descendre à la station "ESPLANADE La-Défense", suivre sortie 2 et 10, puis au niveau supérieur, sortie 1 et 5 (5 mn à pied). Pour localisation voir plan.

2. METRO

Take the underground line n°1 Château de Vincennes - LA GRANDE ARCHE - LA DEFENSE. Get out at the "ESPLANADE de La Défense" station, follow exit 2 and 10, and on the upper level exit 1 and 2. Then as in § 1.2. (5 mn walk from metro) (see the map).

3. TAXI

Boulevard Circulaire. File de gauche, entrez "La Défense 4". Suivez le fléchage marron "Livraisons - Taxis La Défense 2" et ensuite »Tour Manhattan".

3. TAXI

Take the "Boulevard Circulaire". On the left lane, choose "La Défense 4". Follow the brown panels indicating "Livraisons - Taxis La Défense 2" and finally »Tour Manhattan".

4. VOITURE PARTICULIERE

Sur le Pont de Neuilly 100 m environ après le pont, prendre la voie de droite, sortir à droite LA DEFENSE 1-2-3, puis la Défense 2-3. Parking les Iris. Prendre l'ascenseur Place de l'Iris

4. PRIVATE CAR

Drive across Pont de Neuilly for about 100 m further along, using the right lane, take the right exit "LA DEFENSE 1-2-3" then take LA DEFENSE 2-3" and drive on to car park les Iris). Take the lift up to Place de l'Iris

Légende
 - Ligne de métro
 - Ligne de RER
 - Ligne de tramway
 - Ligne de bus
 - Ligne de vélo
 - Ligne de train
 - Ligne de métro
 - Ligne de RER
 - Ligne de tramway
 - Ligne de bus
 - Ligne de vélo
 - Ligne de train

