

Global Heritage Network

Site Conservation Assessment Report: Prambanan Temple Compound Indonesia



Prepared for Global Heritage Fund
by Prof. Dr. Inajati Adrisijanti, Andi Putranto S.S.,
and Vinsensius Ngesti W.
Yogyakarta, Indonesia
May 2011

GLOBAL HERITAGE NETWORK
Site Conservation Assessment Report:
Prambanan Temple Compound
INDONESIA

for Global Heritage Fund

Prepared by

Prof. Dr. Inajati Adrisijanti (*Dept. of Archaeology, Gadjah Mada University*)
Andi Putranto, S.S. (*Dept. of Archaeology, Gadjah Mada University*)
Vinsensius Ngesti W. (*Dept. of Archaeology, Gadjah Mada University*)

Contents

Site Background	1-5
Site History	
Site Description	
The Boundary	
Site Significance	
Project Potential	6-8
Planning	
Community	
Conservation	
Partnership	
Site Condition	8-9
Site	
Buffer Zone	
Site Condition and Conservation Detail	10-32
Structure	
The History of the Restoration and the Conservation	
Zonation	
Problem Identification	

Management	34-44
Legal, Regulatory, Authority, and Site Ownership	
Staff	
Funding and Issues	
Boundaries - Buffer Clarity and Enforcement	
Current Legislative and Actual Protection	
Education	
Recommendation on the Management	
Statement of Significance of Prambanan Temple Compounds	44
Threats	44-48
Environmental Threats (Rain, Temperature, Humidity)	
Artificial Threats	
Management Scorecard (Relative to comparable sites in the regional country)	48-51
Stakeholder	52
Tourism	53-56
Bibliography	57

1. General Information of Prambanan Temple Compound

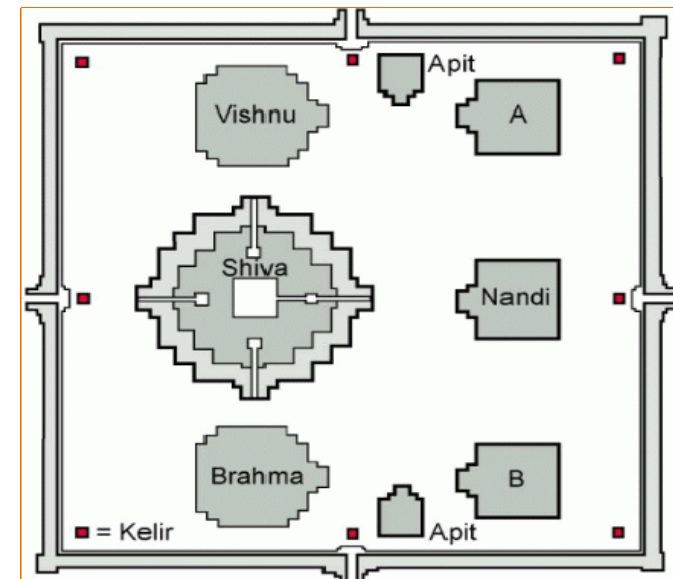
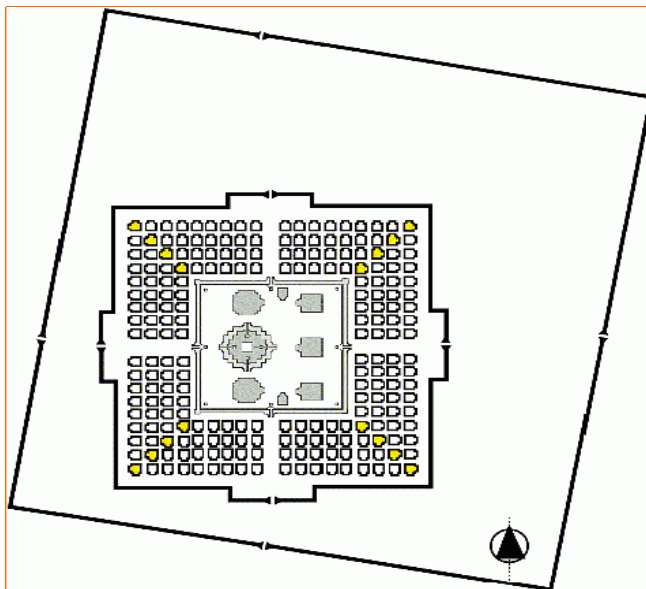
1. a. Site History

Prambanan Temple Compound was rediscovered by C.A.Lons on 1733 during the Dutch East-Indies period. Then the Governor-General of Java Island, Nicolas Engelhard, told Cornelius and Waardenar to clean the compound and set up a research on it. During the British East-Indie time, Th.S.Raffles as the Governor-General told Mackenzie and Baker to set up survey in order to make a full description of the temple compound. On 1885 J.W.Ijzerman cleaned up the whole compound which was full of shrubs and trees. The activity was continued by Gronemann on 1889. Th. Van Erp begun with the preliminary effort to restore the main temple (Siwa Temple), especially the main room. Then the restoration was continued by F.D.K. Bosch on 1918. The Archaeological Office (*Oudheidkundige Dienst*) continued the restoration lead by Van Romondt on 1938 – 1945. During the Japanese Occupation in Indonesia, the restoration activity was continued under the leadership of Indonesian staffs, Soehamir, Samingoen, and Soewarno. The restoration of Siwa Temple finished on 1953, and officially announced by President Soekarno. On 1996 the 16 main temples in the main courtyard were completely restored. Then came the big earthquake on May 27th 2006. It damaged the compound.

1. b. Site Description

Geographically Prambanan compound lies on the plain near the foot of the Merapi volcano and close to Opak river. Administratively it stands in Bokoharjo village, Prambanan sub-district, Sleman regency, Yogyakarta Special Province. It stands on the northside of the main road between Yogyakarta and Solo. Its location is strategic and accesible easily from big cities in the area. The Prambanan compound consists of Hindu temples from the 9th century, arranged on three ourtyards . The whole compound lays on 49.284 m² area. Siwagrha inscription from the year 856 AD tells us about the building of the compound: King Rakai Kayuwangi officially announced that the sacred compound was complete. Prambanan temple compound

consists of three concentric courtyards. On the first courtyard (the main courtyard) there are 16 temples. They consist of three main temples (Brahma temple, Siwa temple, Wisnu temple. Out of the three Siwa temple is the grandest, therefore it might be the core of the main temples). Beside the three main temples, at the first courtyard there are also: three *wahana* temples, two *apit* temples, and eight *patok* temples. At the second courtyard there are 244 *perwara* temples (minor in function and smaller in size). The third courtyard contains no trace of temple, there is only stone fence as boundary between the sacred and the profane areas. In the present Prambanan compound consists of three zones, i.e. main zone, buffer zone, and development zone. Adjacent to Prambanan compound there are Sewu temple compound, Plaosan temple compound. About 5-6 km to the west there is Kedulan temple, and on similar distance to the south there is Sojiwan temple.



1. c. The Boundary

The North side:

On the north of Prambanan temple compound there is the Sewu Buddhist temple compound. Beside the Sewu temple compound, there are also rice-fields and villages. Topographically the area on the north side of Prambanan temple compound is the slope of Merapi volcano, and morphogenetically it was formed by the sedimentation process of the young volcanic soil of Merapi volcano. It consists of loose fine sand to boulders (Wirasanti, 2000: 55)

The South side:

On the south of Prambanan temple compound is the provincial main road from Yogya to Solo, connecting Yogyakarta Province to Central Java Province and East Java Province. It is a busy main road with many types of vehicles passing by. On the south side of the road there is the bus terminal and the market. Topographically the southern area is hilly with denudational structure. It was formed by geological structure consisted of folds and faults now eroded and molded (Wirasanti, 2000: 57).

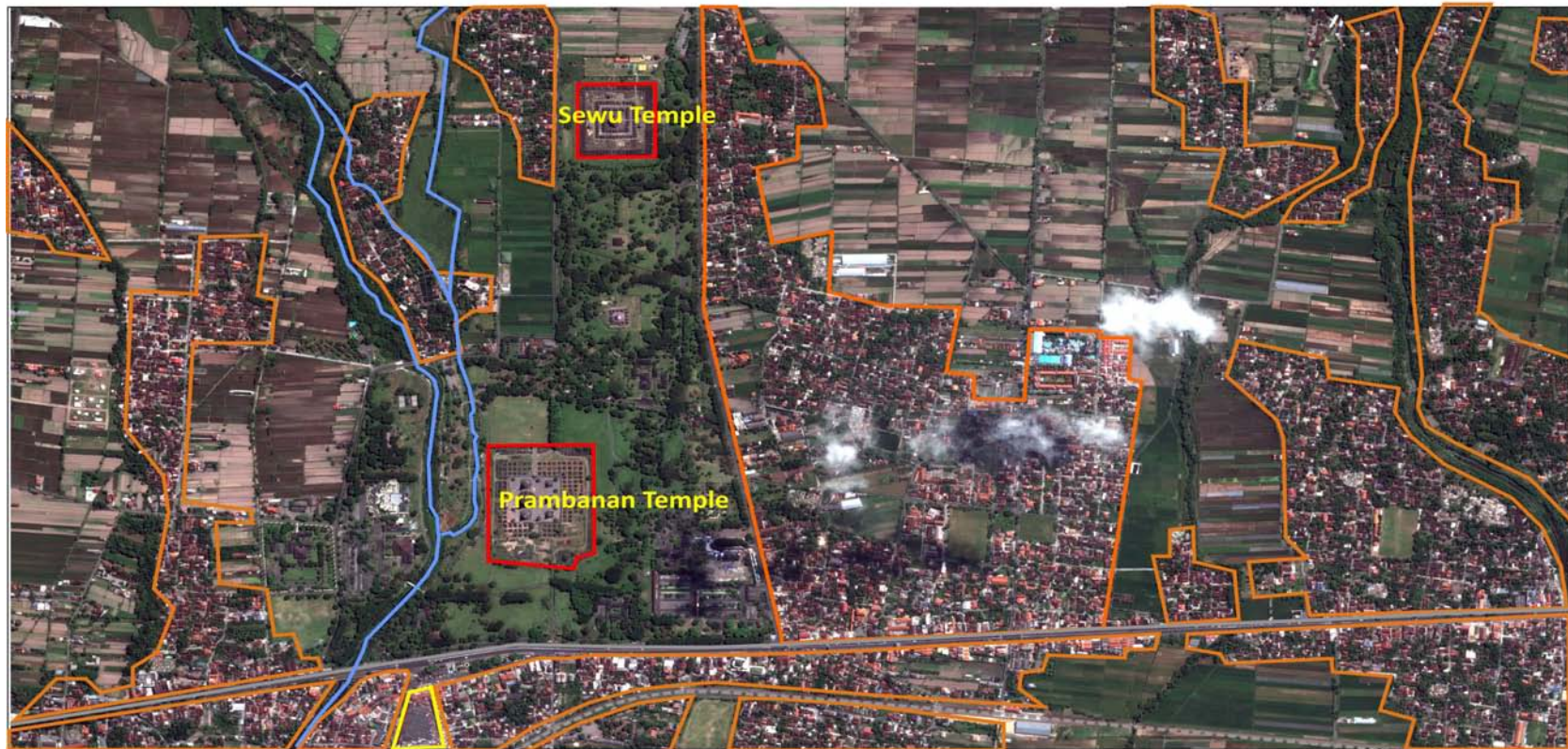
The East side:

On the east side of Prambanan temple compound the land is mainly used as rice- fields and villages. About 2 kilometers to the east of Prambanan temple compound there is another Buddhist temple compound i.e. Plaosan temple.

The West side:

On the west side of Prambanan temple compound flows Opak River and Ngampon River, whose upper course is in area of Merapi volcano. Those two rivers meet by the west side of Prambanan temple compound which is called *tempuran*, means the meeting point. Between those two rivers there is a small delta called *pulo* by the local people. This *pulo* in the present day is used as a camping ground

Map of Prambanan Temple Compound Area



Legend



Temple Area



Traditional Market



Main Road



Settlement Area



River



Railway

1. d. Site Significance

Prambanan compound is a Hindu temple compound, built on the 9th century. Its architecture and decorations is beautifully designed and presented. The reliefs consists of scenes taken from Ramayana and Kresnayana Epics, dances scenes, immortal beings, and also daily life scenes. The statues of the gods also beautifully carved, with exact components of gods' statues. The lay-out of the concentric courtyards and the lay-out of the temples show the genius thought of the conceptor, the architects of the 9th century. The tall and slender building marks the transition period from the Central and the East Javanese sacred architectural tradition. To reach the best location for the sacred buildings, the builders and also the people at that time move the flow of the nearby Opak river, as mentioned in the Siwagrha inscription. All of it prove a genius ancient craftmanship. Prambanan compound is Hindu, but nearby there are Buddhist temples. It means that in the ancient time people with different religious background live harmoniously. Its components show special values, so important it has to be handed down to the present and future generations, either Indonesian or universal ones. Therefore Prambanan Compound announced as one of World Heritage site no. 642. The beauty and attractiveness of the compound make it as one of the prominent tourim destinations in Indonesia



**Short Information
of Site Significance**

2. Project Potential

2. a. Planning

1. Action Plan on the Restoration after Earthquake Damage, Management, Development as a Major Tourism Destination, Training on Disaster Risk Management
2. To arrange a 2011 National Team for the Reconstruction of Siwa Temple

2. b. Community

There are several NGOs who concern heritage preservation in Yogyakarta which is 15 km to the west of the temple:

1. Jogjakarta Heritage Society (JHS)
2. Yogyakarta Heritage Trust (YHT)

Beside those two NGOs there is Department of Archaeology (Faculty of Cultural Sciences, Gadjah Mada University)

2. c. Conservation

1. The effect of the 2006 earthquake towards the temples in Prambanan compound. 15 temples out of 16 temples in the main courtyard have been reconstructed on 2007 – 2010 by the Indonesian experts, with assistance from Japanese experts especially on Geology and Earthquake, and also special quality scaffoldings. But problem arises for the rehabilitation of Siwa temple. Its restoration was done since early 20th century. Many technical drawings lost during the Second World War. And the technique of the restoration makes the structure massive and rigid. Experts can not decide the way to dismantle the stone

blocks to repair the damage without the technical drawing shows the place of the concrete reinforcements. The need is to find the technical drawings, or other documents that might be found in the archives in the Netherland. Or finds the technique to dismantle the stone blocks of the massive structure. During the experts meetings, either international or national, there were no satisfying ideas on the way to restore the temple. Recently a film-maker in the Netherlands gave a short documentary film contains scenes on the previous restoration process. This film might give a preliminary solution on the problem. The other problem is the worn-out of the stone surface used in the staircase and the floor, as an effect of the crowdings of visitors.

2. The international efforts set up by the government are inviting International experts to discuss the problem with national experts and seeking the solutions.
3. Doing comparative study to the countries having experiences in restoring heritage after earthquake disaster, and having experiences in disaster preparedness.



Restoration activity in Prambanan Temple Compound
(Photo courtesy of BP3 DIY)

2. d. Partnership

Domestic Non Governmental Organization :

- IAAI (Ikatan Ahli Arkeologi Indonesia) = Association of Indonesian Archaeologists
- BPPI (Badan Pelestari Pusaka Indonesia) = Committee for the Preservation of Indonesian Heritage

International :

- Dr. T. Hanazato (Tsukuba University, Japan) and other experts on civil engineering especially related to earthquake
- Prof. Giorgio Crocci and Prof. Constantino Meucci from University of Rome
- UNESCO
- Japan Government, Pakistan Government, Egypt Government, Saudi Government, and other parties giving attention to conservation and preservation problems

3. Overview of Site Condition

3. a. Site

During the past 30 years the condition of Prambanan compound is good. The Indonesian Government gives enough attention to it by giving fund for the restoration. On 1996 the 16 temples in the main courtyard are restored completely. The next activities are to conserve and to keep the condition of the temples and the other heritage in the compound, by using every safe means. The Archaeological Office in the area set many monitoring devices, e.g. humidity monitor, rainfall monitor, and also seismograf after the 2006 earthquake (aid from Japan Government). The presence of garden in the buffer zone shares in keeping the micro-climate in the area. It also give space for the visitors to make them not giving burden to the temple, especially during peak seasons. There are new construction, but they were placed in the buffer zone

New constructions for tourism give no destructive effects on Prambanan compound. But we must think about the crowding of the traffic on the main road. Does the traffic yield pollutants endangering the temples or not? Research on it should be done. Sometimes the development zone are used as a place for musical shows for young people. Some people consider it as normal condition, as long as the management gives informations about the temple as national and international heritage, its values etc. It makes the young ones visit the heritage. Once or twice in a year it is also used as the place for Hindu rituals commemorating *Nyepi* and *Galungan* events. In short there is no significant disturbs towards the temple compound Even the informal souvenir sellers do not disturb the visitors so much.

3. b. Buffer Zone

Prambanan temple compound is divided into three zones: the core zone, the buffer zone, and the development zone. The core zone includes the temples and the supporting components (the stone fence, the gates). The management of this zone is in the hand of the Balai Pelestarian Peninggalan Purbakala (Archaeological Office) of Yogyakarta Province. While the management of the second and third zones are in the hand of P.T.Taman Wisata Candi Borobudur, Prambanan, and Ratu Boko. This office has to manage the area as a profitable tourism destination. On the other hand the local government does not involve directly in the management of Prambanan compound, but they get incentive from the ticketing. The Archaeological Office also get some money from P.T. Taman Wisata as a means to participate in the protection of the compound.

4. Site Condition and Conservation Detail

4. a. Structure

4. a. 1. Wishnu Temple

Prior to the 2006 earthquake Wisnu temple has been restored on 1982-1991. Actually its restoration begun on 1951, but then it stopped, and restarted again on 1982. After damaged by the 2006 earthquake its structure was cracked, a bit tilted, many components detached, deformed, broken, and collapsed. Many fallen stone blocks were broken into fragments. On It was re-restored to its original condition.



The damage occurred in Wishnu Temple
(Photo courtesy of BP3 DIY)

4. a. 2. Siwa Temple

Siwa temple is the grandest building in the compound. Its primary restoration done on 1889- 1953. According to some archives and old photos the restoration was done on the body up to the roof of the temple, while the foot and the foundation were not restored because they were still stable, not deformed. The 2006 earthquake caused the structure of Siwa temple experiences damage. There are cracks 4-5 cm wide on the west sub-basement, and on the north-east and south-west parts of the foot as well. There are also outward shifts 4 cm long at the south and east stairways. On the wall of the body of the temple there are many vertical and horizontal micro cracks. Besides there were fallen, broken, and cracked stone-blocks, even some blocks experienced outward shifts caused by stress.



The damage occurred in Siwa Temple
(Photo courtesy of BP3 DIY)

4. a. 3. Brahma Temple

Prior to the 2006 earthquake Brahma temple was restored on 1978 – 1987. The restoration was done from the foundation up to the roof, by inserting concrete reinforcements. During the 2006 earthquake the temple experienced cracks, some stone blocks of the roof and north balustrade fell down and broken. The fallen stone blocks also damaged the body and the foot of the temple.



The damage occurred in Brahma Temple
(Photo courtesy of BP3 DIY)



4. a. 4. Garuda Temple

Prior to the 2006 earthquake Garuda temple was restored on 1991 – 1993 simultaneously with the other smaller temples in the first courtyard. But the earthquake damaged the temple again, especially on the roof. Some components of the roof, e.g. the *ratna*, shifted, or detached and fell down in the courtyard. The balustrade also damaged, e.g. some *ratnas* fell down also. Many stone blocks cracked or broken. Its restoration was carried out on 2007-2008



The damage occurred in Garuda Temple
(Photo courtesy of BP3 DIY)

4. a. 5. Nandi Temple

Nandi temple actually was restored on 1991-1993 together with the smaller temples in the 1st courtyard. During the 2006 earthquake Nandi temple did not experience heavy damage, except the top of the finial was broken and several *ratnas* of the balustrade were broken. Its restoration was carried out on 2007-2008.



The damage occurred in Nandi Temple
(Photo courtesy of BP3 DIY)



4. a. 6. Angsa Temple

The 2006 earthquake damaged Angsa Temple similar to the other temples. Several *ratnas* of the roof and of the balustrade broken and fell down, many stone blocks were also broken and cracked. This temple was restored again on 2007-2008.



The damage occurred in Angsa Temple
(Photo courtesy of BP3 DIY)

4. a. 7. North Apit Temple, South Apit Temple, Patok Temple, Fence and Gateway

The damage on the North and South Apit Temple mainly were material damage, i.e. the stone blocks were broken and cracked. The finial of the North Apit Temple was broken and fell down, thrust in the ground. The eight Patok Temple only experienced deformation on the finials which could be restored quickly afterwards. But the enclosure wall and the gateways were crumbled down.



The Damage
(Photo courtesy of BP3 DIY)



Restoration Activity



Damage I in several area
(Photo courtesy of BP3 DIY)

Based on the observation, excavation, and the analysis on the damage experienced by the temples after the earthquake, we concluded that:

The foundation of the temples did not experience severe damage, because the earth nearby was strengthened using a mixture consisted of sand, small and bigger gravels. The damage on the temples' wall occurred on the outer face, especially on the stone connection using modern adhesive (cement-p.c.) as can be observed on Siwa Temple.

1. The foundation of the temples in the first courtyard do not experience significant damage as the soil structure around the foundations has been strengthened by a compact mixture consisted of sand, gravel and pebble

2. The damage on Siwa temple's wall happened on the surface of the joints among the stone blocks which used pc cement as adhesive agent and iron dowels in the inner surface. It was an ordinary technique during the restoration before the World War II.
3. There were deformations on many parts of the temples
5. There were slanting position on the building of Siwa temple, Wisnu temple and Brahma temple

This is the data on the damage of the stone blocks of the buildings in the 1st courtyard of Prambanan Temple compound. It consisted of loose, broken, fragmented and cracked stone

No	Building	Amount of Stone			
		Loose	Broken	Fragmented	Cracked
1	Brahma Temple	52	149	161	21
2	Siwa Temple	7	277	563	479
3	Wisnu Temple	6	20	101	58
4	Garuda Temple	12	15	28	0
5	Nandi Temple	16	32	147	18
6	Angsa Temple	9	13	94	5
7	West Gate Wall 1	300	-	-	-

No	Building	Amount of Stone			
		Loose	Broken	Fragmented	Cracked
8	1 st Compound Wall	1100	-	-	-
9	Apit Selatan Temple	18	22	-	18
10	Apit Utara Temple	22	2	-	-
11	Kelir Temple	12	1	-	-
12	Patok Temple	-	79	-	1

6. a. 8. Planning of the Safeguarding of Siwa Temple

Dismantling and Restoration

Before deciding the necessary restoration intervention, we need to conduct further research and collect the necessary data (such as: topography and coordinates). Without analytical result on architectural structure, we should not conclude ways of restoration plans. Further research or study should be pursued to find out the inner part conditions of the temple by using a discreet element model simulation, concrete material analysis with core drilling operation, georadar scanner, micro camera, topographic analysis, etc.

A task force team under the coordination of the Indonesian Ministry of Culture and Tourism should be formulated which members should be from the Government officials, academic, institutes, national and international experts, etc. Young professionals should be fostered whose expertise shall be structural

architecture, stone conservation, material sciences, seismic study, heritage management, etc. Preventive measures should be considered for the long term preservation of the monument: continuation of on-site monitoring seismographic study, period monitoring data analysis, and so forth.

Structural Reinforcement (Recommendation)

- Noted that current condition of Siwa Temple apparently need further research (e.g. horizontal cracks).
- Encourage to study more on some historic documentation of Siwa Temple restoration in the past from archives (in the Netherlands) and to compare the inner structure of the temples with similar monument type.
- Encourage to conduct more analytical studies to gather more information on internal condition of the temple, namely through endoscopic research analysis to identify the empty space or damage on the concrete bar. Once the endoscopic research analysis is done, further analysis by opening one or two blocks of the new stones (tunneling analysis) could be conducted to study the condition/structure of the inner part of the temple and to make a more precise model. In order to conduct tunneling analysis, it is necessary to have temporary supports (use steel).
- Also encourage the experts to take into account that mathematical/computer model can only represent some schemes and sometimes the result can be very far from the reality and therefore simplified model which can better represent the behaviour of the future could be used to evaluate the sheer forces.
- Recommend the experts to contact the Ministry of Public Works and/or Bandung Institute of Technology of Geology Department, Gadjah Mada University (since these institutions have already a seismic zoning map in Indonesia) in order to gather the data on probability seismic hazard analysis for Prambanan Temple Compounds. Locate the Prambanan coordinate in the seismic map.
- Suggest to set up a good base to gather information on the studies and interventions conducted so that if any disasters which may occur in the future, the future generation could have complete information.

Material Conservation

The main issue is to stop water seepage in the temple. This can be achieved by implementing the following :

1. Collect all scientific information and analysis about the material and the degradation of the stone blocks
2. Take samples of both the original and restored material from the inside of the upper part of the temple to determine the degree of degradation
3. Reduce the use of epoxy resin to fill the cracks, either micro and macro, and apply only to the cracks that may affect the stability.
4. Fill in cracks with wax for temporary use and traditional mortar after the study is completed.
5. Study the differences between the stone blocks (old and new) which experience mechanical damage and assess the suitability of commercial products to strengthen and waterproofing the stone.
6. Biologically treated the temple by locally applying suitable biocides, and apply every six months.
7. Study the suitability of the traditional mortar (started already, when the best mixture is ascertained through studies at Borobudur it can be used in Prambanan) and use silicon rubber, elastic mortar for temporary use.
8. Study the impact of the increase of temperature in the environment.

4. b. The History of the Restoration and the Conservation

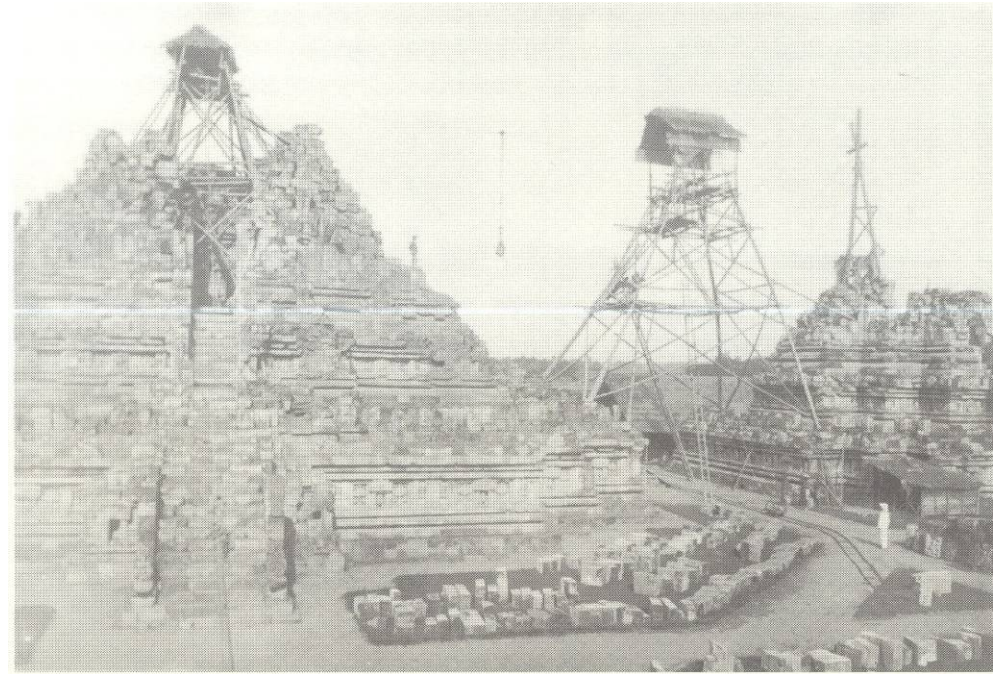
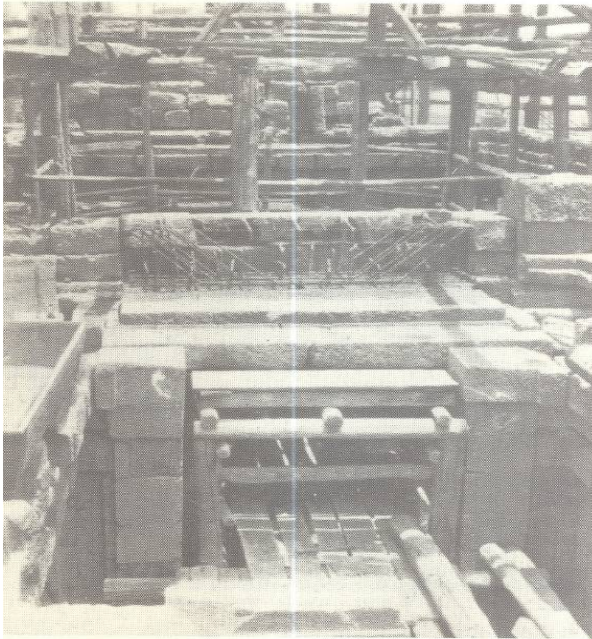
According to the archives, the reconstruction activities began on 1885 led by J.W.Ijzerman as the Head of *Oudheidkundige Vereeniging*, an NGO at that time. He ordered the workers to clean the courtyard from the scattered stone blocks without any documentations. Later, it turned out that this activity made the restoration di

sturbed, because the restorer had to seek the stone blocks not at certain place. On 1889 Groeneman explored all temples in the 1st courtyard, but he did nothing else, on the contrary he ordered to put away many stone blocks to the edge of Opak river flows at the west of the compound.



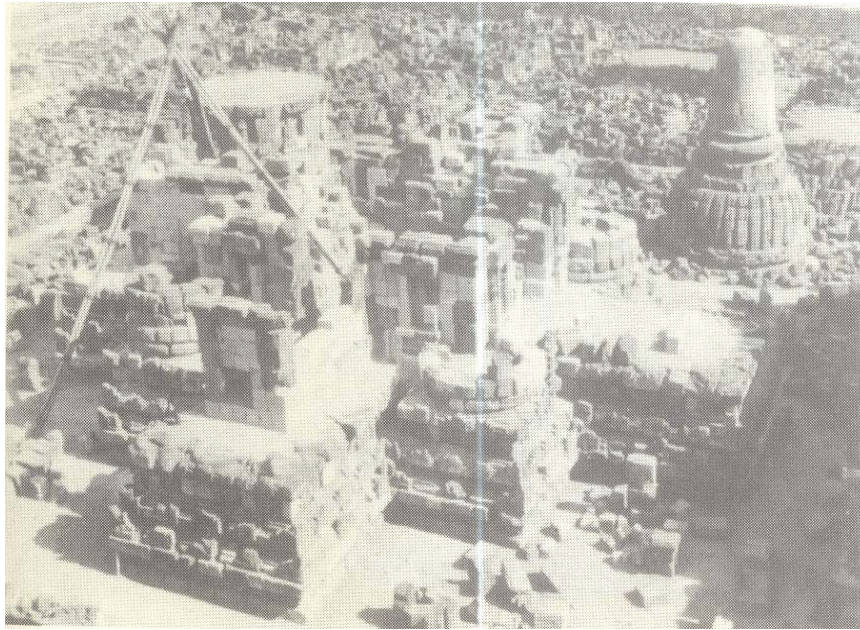
The Prambanan Temple condition when it was rediscovered

On 1902 -1903 Th. Van Erp started restoring the crumbled chambers of Siwa temple. In the photographs it is clear that the inner wall of the roof was strengthened by concrete slabs.



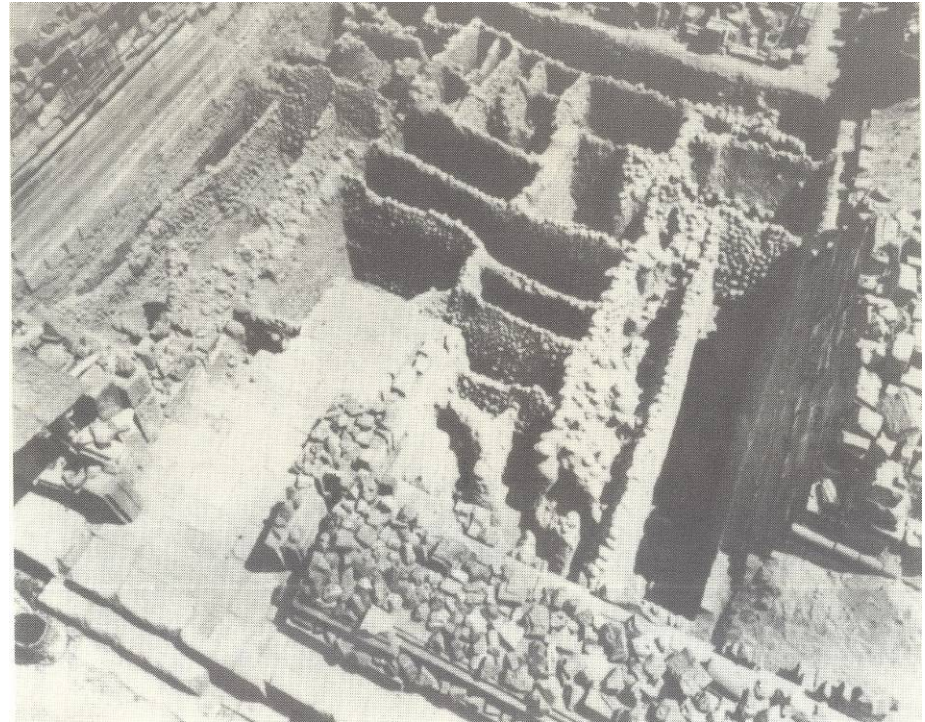
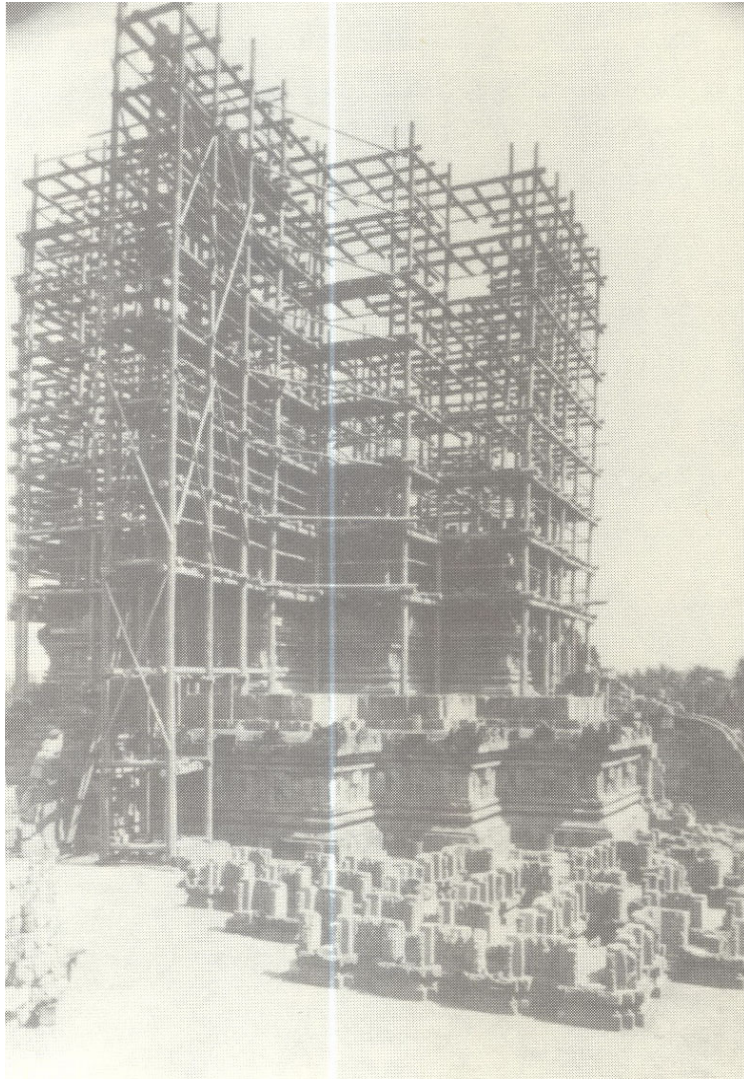
Early restoration activity

But, systematic restoration by *Oudheidkundige Dienst* just started on 1918 led by Perquin. It means that they began classifying the fallen stone blocks, dismantled the stone blocks, putting location marks on it, making trial construction, and putting new stone blocks as substitute for the missing original ones.



Early restoration activity

On 1927 De Haan continued the restoration. He and his crew succeeded to set up trial construction of the foot of Siwa temple. The work was continued by van Romondt since 1930, assisted by van Coolwijk, Soehamir and Samingoen.



Early restoration activity

When the Japan Army came on 1942, the situation changed. The restoration activity stopped, the Dutch staffs of Oudheidkundige Dienst were interned. Therefore the Indonesian middle staffs held the office, and restarted the restoration

On 1945 when Indonesia proclaimed its freedom, the restoration of Siwa temple reached 32.5 m high, but the Dutch Military Aggression stopped the restoration again. It started again on 1949 when the situation was normal. The work was continued by *Bagian Purbakala Djawatan Kebudayaan Republik Indonesia* (the Indonesian Archaeological Office), but still led by van Romondt. The work finished on 1950 as proclaimed by President Soekarno, the first president of Republic Indonesia.

After the official announcement the work continued to the other temples in the 1st courtyard of Prambanan temple compound. The restoration of Wisnu temple and Brahma temple began on 1951, by making trial constructions which completed on 1971. The restoration of Brahma temple was completed on 1987, while that of Wisnu temple finished on 1991. The restoration of Wahana temple, Patok temple and two Perwara temple completed on 1993.

On the year 2006 a big earthquake with 5.6 Richter scale occurred in the region of Yogyakarta. Many buildings damaged, including Prambanan Temple compound. The damage at Prambanan Temple compound has to be restored, since the compound is included in the World Heritage, and one of the main tourism destination in Indonesia. It has scientific significance, cultural significance, aesthetic significance, and economic one as well. Therefore, the first activity was emergency response, then followed the post-disaster rehabilitation

Since 2006 rehabilitation activities on Prambanan Temple are:

- Emergency response I on 19th June – 15th August 2006
- Emergency response II on 16th August – 30th September 2006
- Technical study on the South Gate of the 3rd courtyard on October 2006

- Technical study on Wahana Temple on December 2006
- Technical study on Wisnu Temple, Siwa Temple, and Brahma Temple as well on January 2007 – March 2007
- Geotechnic research, geoelectric and georadar tests on March 2007
- International Expert Meeting on the Rehabilitation of Prambanan Temple compound on March 2007
- National Technical Meeting on the Rehabilitation of Prambanan Temple compound on March 2007
- Evaluation on the system of joint strengthening of the stone blocks at Wahana Temple on June 2007
- Research on the ancient river near Prambanan Temple compound on August 2007
- Installing the seismometer in the temple on November 2007
- Observation on the concrete used in Prambanan temple restoration on December 2007
- Rehabilitation of Garuda Temple 1st period on October 2007 – 2008
- Rehabilitation of Nandi Temple completed on 2008



Rehabilitation activity after 2006 earthquake
(*Photo courtesy of BP3 DIY*)

Then the Indonesian Government plans activities for the restoration and rehabilitation of Prambanan temple compound. They are:

- International Expert Meeting for the Restoration of Siwa Temple held by UNESCO on March 2011
- Set up The National Conservation Team for the Restoration of Siwa Temple on 2011
- The restoration activities of Siwa Temple on 2010 – 2019
- Restoring the enclosure wall of the 1st courtyard on 2011
- Restoring the south gate of the 1st courtyard on 2016





Restoration activity after 2006 earthquake
(Photo courtesy of BP3 DIY)

4. c. Zonation

On 1980s the Indonesian Government began managing Prambanan Temple compound as one of the main tourism destination in Indonesia to add to the State finance. The Indonesian Government also set up *PT Taman Wisata Candi Borobudur dan Prambanan* to manage those two temple compounds as tourism destinations. Since then the management of Prambanan Temple compound held by two institutions i.e. The Archaeological Office of Yogyakarta (*Balai Pelestarian Peninggalan Purbakala Daerah Istimewa Yogyakarta*) to manage the archaeological /heritage matters, and *PT Taman Wisata* to manage the tourism matters. This management matters is arranged in Indonesian Presidential Decision (*Keppres R.I.*) number 1 year 1992,

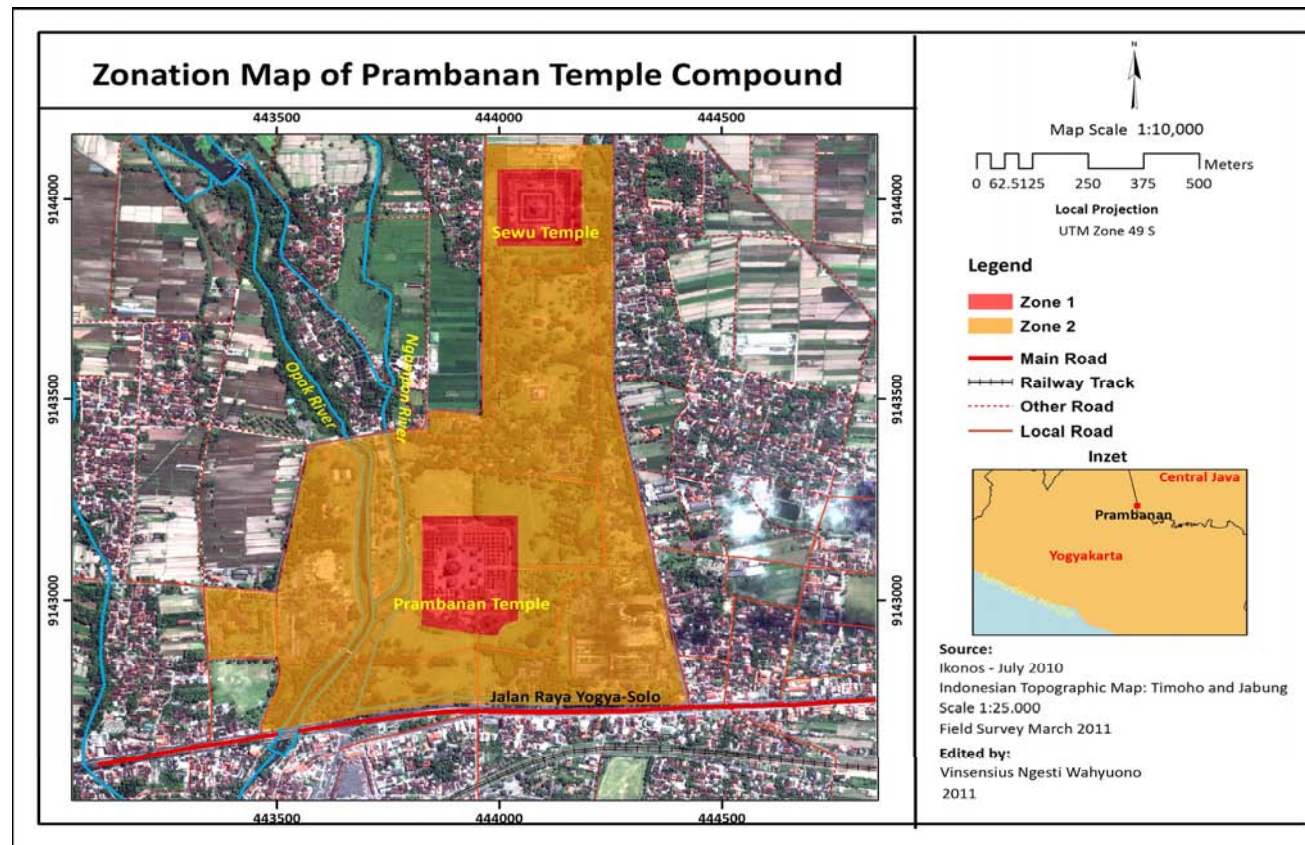
On The Management of Tourism Park of Borobudur and Prambanan Temples and Their Environments. In the Presidential Decision the physical environments of Prambanan Temple compound and Borobudur Temple compound are divided into three zones. They are:

- Zone 1
This nucleus zone contains the archaeological buildings and area to be protected, to be maintained, to be conserved. Its width is 39.8 ha. It is under the authority of BP3 Yogyakarta.
- Zone 2
This zone is the outer ring of zone 1 and functions as the supporting area for it. It is the space for tourism facilities, cultural activities, and conservation facilities. The width of this zone is 37.2 ha, and it is under the authority of PT Taman Wisata
- Zone 3
This zone is the development area used for limited settlement, agrarian activities, green belt, and other facilities as far as it is in context with site's conservation. The arrangement of zone 3 is kept to be in line with inner zones. Its width is unlimited, meaning that in certain condition it could be widened. Zone 3 is placed under the authority of the local government, in this case the Regency of Sleman and the Regency of Klaten.

The local government as the administrative authority does not involve directly in the management of Prambanan Temple compound. But they get incentive from the ticket sold. PT Taman Wisata also gives fee to BP3 for the maintain of the site.

In the management of Prambanan Temple compound there is a different orientation between BP3 and PT Taman Wisata. BP3 is a state institution who concentrate on the conservation of the site as an important tangible heritage – moreover its status as World Heritage --, while PT Taman Wisata is a profit oriented state owned company. This difference in their orientation makes it possible to create a different view in the

management of the site. Therefore the two institutions and the local government have to set up continuous coordination.



Zonation Map of Prambanan Temple Compound

4. d. Problem Identification

The problems occur in Prambanan temple compound can be divided into two, i.e. the problems occurred prior to the 2006 earthquake, and the one occurred after the earthquake because the 2006 earthquake affected many physical components of the temples.

Prior to the 2006 earthquake the problems in Prambanan temple compound especially was conservation problems, e.g. the salting on the stone blocks caused by the use of p.c. mortar during the pre- World War II. Besides, there grows lichen, algae and fungi, which must be cleaned periodically to maintain the cleanliness of the stone blocks of the temples. Another problem comes a.o. from tourism and its impacts, especially the arrangement of the tourists flow, the regulation about hawkers, the arrangement of the souvenir stalls, the keeping of the compound cleanliness, the compound security.

When the 2006 earthquake happened, the problem on the Prambanan temple compound were structural ones. It all happened because of the strength of the earthquake and the location of the compound. It stands exactly beside the Opak river that is one of the active fault in Indonesia. It caused quite heavy damage on the compound. The damage on the Prambanan Temple compound were: collapse, broken, shift, and slant.

Post-earthquake activities in Prambanan Temple compound were: data collecting, dismantling the damaged components, rehabilitation and strengthening, research and test on material will be used in the restoration to choose the safest one.



The restoration of the damage temples and other building in Prambanan Temple compound were done by prioritizing physical components and strengthening the structure of the temples,



Restoration process
(Photo courtesy of BP3 DIY)

Problem on the restoration of Prambanan Temple compound is on Siwa Temple. As we already know its restoration was done before the World War II on the body to the rooftop, while the foundation to the foot of the temple was left as it was. But the reports and documentations that were uncovered were not enough to be used as the base for restoring the temple. Actually the damage on Siwa Temple caused by the earthquake are similar to the other temples: cracked, collapsed, deformation. But, the restorers can not dismantle the the cracked components of the temple's body and roof, as the exact position of the inserted new concrete components were unknown; meanwhile the reports said about the installation of iron dowels and pc cement on the inner stone blocks of the temple wall. Up to this time experts think about ways to observe the condition of the inside 2m thick wall, but there is no satisfying result. It makes the obstacle and significant hindrance to restore Siwa Temple, as the dismantling of the stone blocks of the temple without knowing the condition of the strengthening has been applied toward the original structure is highly risky.

5. Management

5. a. Legal, Regulatory, Authority, and Site Ownership

The management of Prambanan Temple compound is arranged in the Presidential Decision of the Republic of Indonesia no 1 year 1992 On The Management of Tourism Park of Borobudur and Prambanan Temples and Their Environments. In the Presidential Decision it is mentioned that Prambanan Temple compound consists of three zones: core zone, buffer zone, development zone.

The core zone is placed under the authority of BP3 Yogyakarta as a state institution whose duty are a.o. to do protect and to conserve the heritage situated in its territory. BP3 Yogyakarta has a site office for Prambanan Temple compound called *Unit Prambanan* with special duty concerning the protection and conservation on the site.

The buffer zone (zone 2) is managed by PT Taman Wisata Candi Borobudur, Prambanan dan Ratu Boko, a state owned company. As a profit oriented company it manages the buffer zone as tourism area by bringing forward protection principles for the heritage. The profit mostly comes from the entrance ticket to visit Prambanan temple (Rp.20.000,00 for domestic visitor and \$13 for foreign visitor). Out of the profit PT Taman Wisata has to give some amount of money to contribute for the conservation of the temples about 20% out of the monthly profit from the entrance ticket.



Ticket Boxes



Ticket /Access Card

The development zone (zone 3) is under the authority of the local government. Those are: the Regency of Sleman (the Special Province of Yogyakarta) and the Regency of Klaten (the Province of Central Java). The area of Zone 3 has no absolute fixed boundary, as the width adapts to the Plan of the Area and Its Lay-out planned by both regencies. But, they have to put the conservation principles as their reference, especially the Prambanan Temple compound.

5.b. Staff

As mentioned before, BP3 Yogyakarta and PT Taman Wisata managed the core zone and the buffer zone of Prambanan Temple compound. To support their duties they have educated staff and other skilled manpower, and the infrastructure.

1. Site Office of Prambanan/ Prambanan Unit of BP3 Yogyakarta

No	Occupation	Amount
1	Archaeologist	3 persons
2	Techno-conservator	3 persons
3	Administration	2 persons
4	Maintenance and Restoration Personel	45 persons
5	Security	25 persons

2. PT Taman Wisata

The data on the amount of personels of PT Taman Wisata is inaccessible

5.c. Funding and Issues

Fund for maintaining and conservation of Prambanan Temple compound comes to BP3 Yogyakarta from the Department of Culture and Tourism via the Directorate General of History and Heritage. Then BP3 Yogyakarta allocate special fund for the Site Office of Prambanan to handle the maintaining and conservation activities which can be divided into routine and project ones. The routine activities consists of maintaining and keeping the temples and the site in order, while the project activities are not fixed, depend on urgent condition e.g. major improvement, restoration, that usually planned for a long period, e.g. the rescue activity after the 2006 earthquake

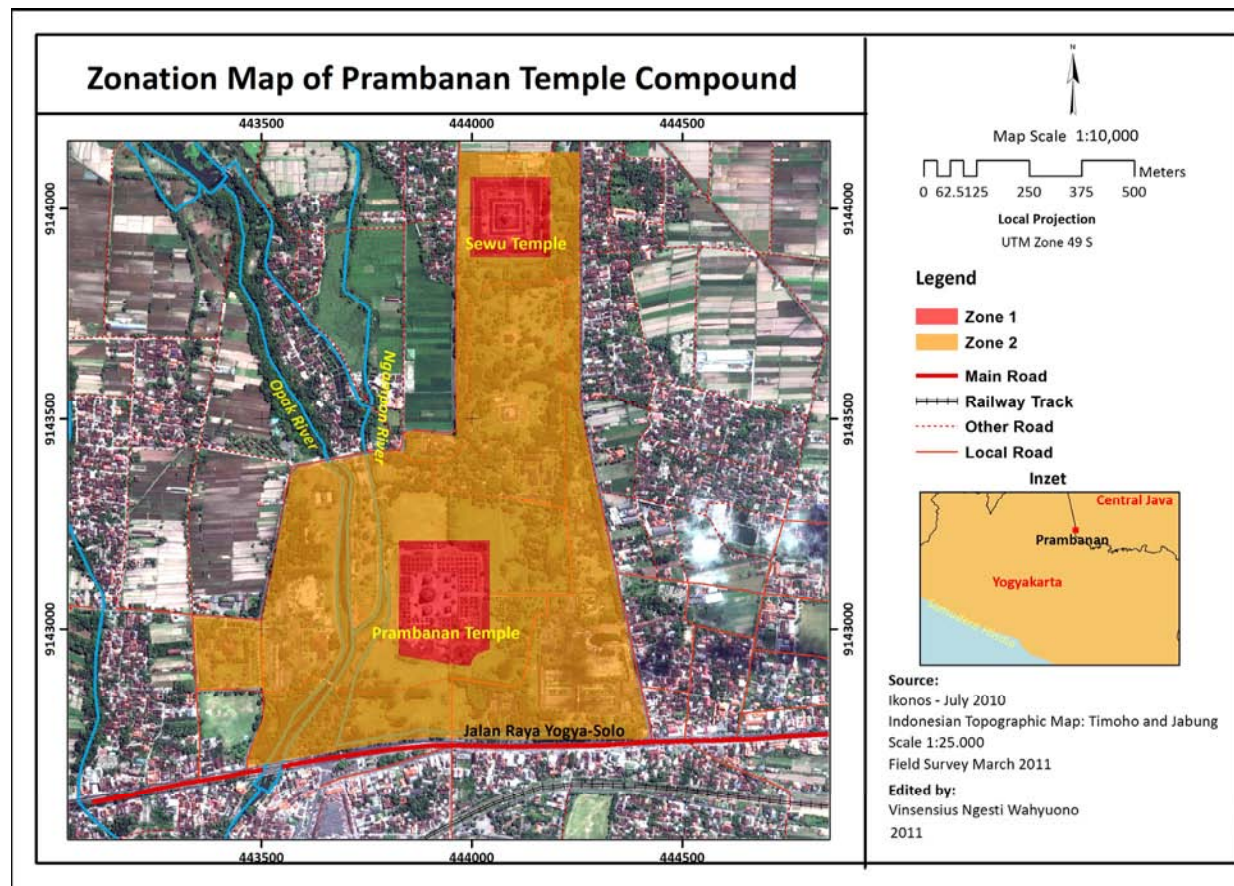
Beside the fund from the Department, BP3 Yogyakarta also get fee from PT Taman Wisata about 15 % - 20 % from the profit out of the entrance ticketing

After the 2006 earthquake there were also funds coming from donator countries e.g. Japan, Saudi Arabia, UNESCO for rescue and emergency activities, setting up post disaster studies, and inviting international experts to give suggestions for the rehabilitation of the heritage buildings after the earthquake. But, this type of fund is not continous. It is funding for post disaster activities.

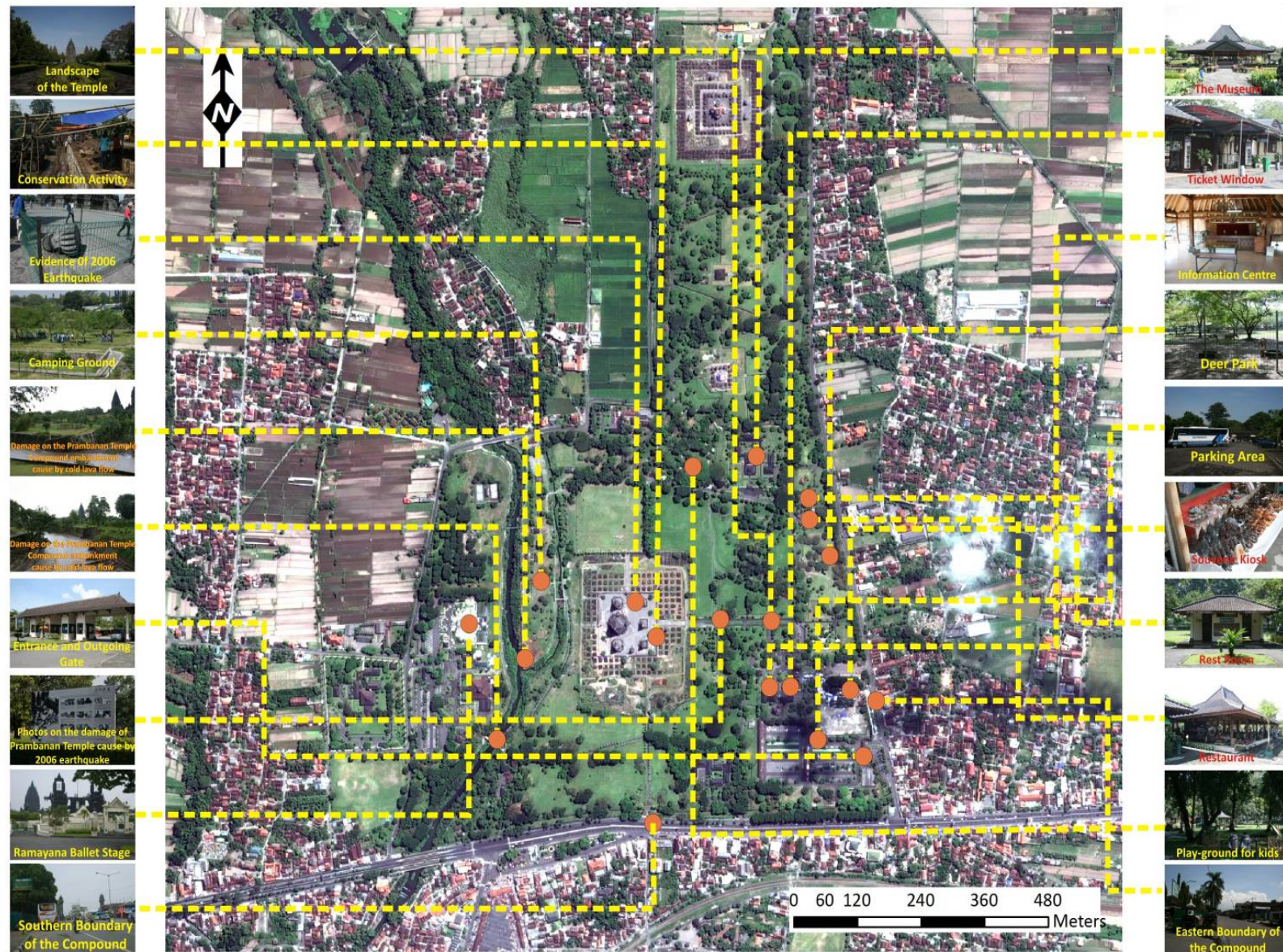
The fund exists in the present time is not adequate compared to the duty to maintain, to restore, and to conserve Prambanan Temple compound from damage caused by nature and by human beings.

5.d. Boundaries - Buffer Clarity and Enforcement

To determine the boundary of the present zones in Prambanan Temple compound people based on the master plan created by JICA (Japan International Cooperative Agencies) on 1978 adjusted to the present condition.



Map of the Area of Prambanan Temple Compound



In the present the boundaries of each zone were indicated by iron fences. In the core zone where the temples present there is no modern building presents, except several lamps to light up the compound in the night



The Lights



Zone 1

Buildings and other facilities for tourism are in the buffer zone. They are: gateways, parking lot and rest area, souvenir stalls, ticket boxes, information center, rest rooms, restaurants, kids park, praying facility, museum, audio-visual show, guides, and photographers.



Information Centre



Photographers Cooperation



Supporting Facilities

In zone 3, on the east of the boundary of zone 2 on the other side of the street there is village, shops, rest rooms, and inns, all owned by the villagers. It must be controlled all the time to avoid uncontrollable physical development related to tourism, although there is already a Regulation on the Lay-out of the Area



Parking Area



Eastern Boundary



Mosque



Souvenir Stall



Restaurant



Museum

5.e. Current Legislative and Actual Protection

Regulations used as protection for Prambanan Temple compound are: The Law of the Republic of Indonesia number 11 year 2010 on Heritage (*Undang-Undang no. 11 tahun 2010 tentang Cagar Budaya*), and The Regulation of Yogyakarta Province number 11 year 2005 on the Management of Heritage Area and Heritage (*Peraturan Daerah Provinsi Daerah Istimewa Yogyakarta no. 11 tahun 2005 tentang Pengelolaan Kawasan Cagar Budaya dan Benda Cagar Budaya*) as Prambanan Temple compound is located in Yogyakarta Province. Besides that, to manage the tourism activities in the compound the Government of the Republic of Indonesia arranges the working system and the authority in the management of the buffer zone by Presidential Decision no 1 year 1992 On The Management of Tourism Park of Borobudur and Prambanan Temples and Their Environments.

5. f. Education

Prambanan Temple compound as a heritage – also one of the World Heritage – does not function as a tourism destination only, but more importantly it has educational function for the society. Not only the

Indonesian society, but also for the international society. Up to the present time we found that the educational facilities in the area is still in average level, although the management do their best to inform the important elements of Prambanan Temple compound. They are in the form of leaflets, maps, information boards, guides, museum, and audio-visual show. But, we do not find higher level informations like booklet, coffee-table book, or academic book, either in Indonesian language or in English, in the information center, in the souvenir shop or in the stalls.



Information Boards

Next to the informations, PT Taman Wisata together with BP3 Yogyakarta recently create special interactive programs mainly for the students. It is special interest tourism in the form of archaeological conservation, and the go green program by tree planting in zone 2.

5.g. Recommendation on the Management

There is lack of SOP (Standard Operating Procedure) in Prambanan Temple Compound management, especially as an object of tourism and recent religious activity. SOPs is a set of written instructions that document a routine or repetitive activity which must be followed by organizations in this case PT Taman. The development and use of SOPs are an integral part which result in quality system, to perform duty/activities properly, consistency in quality and integrity of a product or end-result. SOPs must be describe both technically and fundamental programmatic operational elements of an organization worked under work plan. SOPs will minimize activities and promotes quality even if there are temporary or permanent personal changes in term of management. Finally SOPs must be written step by step and easy to read format with redundancy principle (simple and short but complete).

Nowadays Prambanan Temple Compound besides being been used as tourism destination, also been used as a place for religious (Hindu) activities, product promotion, and art performance. There must be regulations for those activities, to make the heritage environment still in a good condition. The regulation used might be in a form of Standard Operational Procedure (SOP) which is now still lacking, both in BP3 and PT Taman Wisata as well. This condition makes both institutes make their own interpretations about what should be done during activities mention above. The SOP should be composed by The Department of Culture and Tourism and BP3 as its unit in the province, PT Taman Wisata and local government. We think that the composing of SOP is an important to keep Prambanan Temple Compound in a good conserve condition, as one of the world heritage.

6. Statement of Significance of Prambanan Temple Compounds

Prambanan compound is a Hindu temple compound, built on the 9th century. Its architecture and decorations is beautifully designed and presented. The reliefs consists of scenes taken from Ramayana and Kresnayana Epics, dances scenes, immortal beings, and also daily life scenes. The statues of the gods also beautifully

carved, with exact components of gods' statues. The lay-out of the concentric courtyards and the lay-out of the temples show the genius thought of the conceptor, the architects of the 9th century. The tall and slender building marks the transition period from the Central and the East Javanese sacred architectural tradition. To reach the best location for the sacred buildings, the builders and also the people at that time move the flow of the nearby Opak river, as mentioned in the Siwagrha inscription. All of it prove a genius ancient craftsmanship. Prambanan compound is Hindu, but nearby there are Buddhist temples. It means that in the ancient time people with different religious background live harmoniously. Its components show special values, so important it has to be handed down to the present and future generations, either Indonesian or universal ones. Therefore Prambanan Compound announced as one of World Heritage site no. 642. The beauty and attractiveness of the compound make it as one of the prominent tourism destinations in Indonesia

7. Threats

7. a. Environmental Threats (Rain, Temperature, Humidity)

Quality reduction of the stone blocks as elements of the temple structure physically and chemically as well. For instance: stone weathering, stone salting, fungi and lichen growing on the surface of the stone blocks and their pores. The open site of Prambanan compound makes the temple straightly exposed to the weather, e.g. rain, heat of the sun, temperature fluctuations. Natural damage especially weathering on the stone blocks as the important elements of the temple structure. It will cause bad implication on the structure. Sustainable and scheduled maintenance and experienced manpower for the conservation works.

Climate Changes

Quality reduction of the stone blocks as elements of the temple structure. Extreme climate change cause change on the length of rainy season and dry season. Long term damage if we do not anticipate against the

weathering and damage on the stone blocks. Its implication will be the reduction on the physical quality of the temple as a whole. Steps to anticipate the climate change including the maintenance system for the temple

Earthquake

Physical damage on the temples including the inner structure. It may endanger the structure of the temple to a dangerous situation to crumble down the temple. In lighter scale the earthquake may cause minor damage, e.g. cracked, broken, deformed, shifted. Prambanan compound stands near the Opak river. It is a part of the active Opak vault which stretched from the southern beach of Yogyakarta up to the Prambanan area, and meets another vault. This condition is potential for tectonic earthquake. The location of Prambanan compound makes it suffered from heavier damage compared to other sites far from the active vault of Opak. Up to the present no one can predict when and where earthquake occurs. But, there is possibility that it can happens again. Therefore damage to the temples in Prambanan might happen again. The strengthening of the temple structure in Prambanan compound has to be prepared well, considering and using the exact principles recommended by the experts, especially civil engineer, expert on earthquake, geologist, and other relevant expertise.

Volcano

Volcanic ash rain and the eruption material can cover the temple, and give negative impact to the porous andesite stone blocks used as elements of the structure. It is because of its chemical character. Besides, there is secondary danger from the eruption of a volcano. It is cold lava flow through rivers sprung from the volcano. This might endanger Prambanan temple compound, since its site is near that type of river. Prambanan temple compound located at the foot plain of Merapi volcano. It is an active volcano with periodic eruption cycle (about once in 4 years cycle). Its primary eruption material consists of volcanic ash that can be blown by the wind to reach far away area, including the area of Prambanan temple compound. The secondary danger of a volcanic eruption is the flow of cold lava through rivers by high outpour of rain.

Damage to stone blocks as building material of the temples, due to the chemical reaction of the eruption material, and the danger of the cold lava flow. Anticipation steps in the future due to the eruption pattern of Merapi volcano. The future anticipation includes the technique of cleaning the ash rain material from the temple, and the strengthening of the river's slope used as the way for the cold lava flow.



Impacts of Mount Merapi eruption
(Photo courtesy of BP3 DIY)



7. b. Artificial Threats

Pollution

Pollutant brought by the wind can stick to the stone blocks elements of the temple. It can cause quality reduction to the stone blocks of the temple. The location of Prambanan temple compound near the main road connecting Yogyakarta – Surakarta results in high pollution caused by the carbon emission by the motor vehicles. In its turn it may impact towards the everlastingness of the temple compound and the declining quality of the site. Maintaining green activities in the buffer zone as an effort to lessen pollution.

Tourism Activities

The crowding of tourists might cause decline of / sinking of the balustrade floor, the worn-out of the floor surface of the temples. The crowding of tourists triggers the excess of burden to the temple, the worn-out of floor surface caused by the rubbing of the shoes worn by the tourists. Decline of the physical quality of the temples, e.g. sinking, slanting. Those must be anticipated beforehand. The increase of visitors must be balanced by an exact management plan based on preservation principles, to make balance between tourism and preservation/conservation. It will make economic profit without damaging or declining the quality of the site.

Change in land-use

The decline of the environment quality in Prambanan compound connected with the decline of the environment quality outside the compound. It can be seen from the change in the quality of the ground water, local humidity, the decline of the ground quality. Land-use change from agrarian activities into residency can triggers the decline of the environmental quality in the compound. Improvement of the role of

local government in the management and land-use planning and the lay-out of the Prambanan compound area, to make it in coordination with the conservation/preservation principles.

8. Management Scorecard (Relative to comparable sites in the regional country)

Area of Assessment	Score (1-10 Best)	Comments
Overall Protection – Site Core	9	The present condition of the core zone shows that it is well protected either physically or legally as well
Overall Protection – Buffer Zone	9	The present condition of the buffer zone shows that it is protected and the activities in it is organized enough
Site Condition – Physical	9	The site is well cared and protected
Site Condition – Perceptual	9	The perceptual condition of the site is also good and supported by fair tourism facilities
Setting Condition – Physical	8	In the present there is rehabilitation and reconstruction activities for the damage heritage caused by the 2006 earthquake
Setting Condition - Perceptual	9	The core zone is clean, well arranged. In general the same condition also occur in the buffer zone, except in the location of the temporary souvenir stalls (the permanent stalls are under construction)
State of Conservation	8	In the present Siwa Temple could not be reconstructed yet

Area of Assessment	Score (1-10 Best)	Comments
Overall Threat Level	8	The most serious threat toward the compound is secondary danger from Merapi volcano, especially cold lava flood. The other threat could be volcanic-ash rain
Visitor Experience / Current Tourism Appeal	9	The amount of tourist visit to Prambanan Temple compound yearly shows an increase. It means that it is still considered as one of the main tourist destination
Tourism Development – Extent	8	Tourism facilities are in good condition, except the placement of the temporary souvenir stalls
Tourism Development – Sustainability	8	Prambanan Temple compound is still considered as a main tourist destination supported by good facilities. Its location is close to several big cities with good transportation and accomodation facilities. In international tourism books it included into main tourism destination in Indonesia
Future Tourism Potential	8	This site can be more developed if the capacity of nearest airport (Adisucipto Airport) is more expanded/developed
Overall Management	7	The overall management is good, but there still no SOP as the guideline for the activities especially in the buffer zone

Area of Assessment	Score (1-10 Best)	Comments
Management Planning	7	For the core zone BP3 Yogyakarta has a good plan for the future already, but PT Taman Wisata has no conservation based plan integrated with the plan for the core zone
Management Resources	7	BP3 Yogyakarta has fair amount of human resource supported by fair facilities, but PT Taman Wisata now has only 1 archaeologist
Community Involvement	9	Local community is involved in the activities in Prambanan Temple compound as staffs and workers either in BP3 Yogyakarta or in PT Taman Wisata. They also have role as food or souvenir sellers, photographers, local guides, art performers

9. Stakeholder

Stakeholder Group	Attitude/Agenda	Representation in tourism planning (actual or potential)	Participation in tourism benefits (actual or potential)	Comments
BP3 (Archaeological Office in Yogyakarta Special Province)	Management activities in the main zone where the heritage presents.	-----	-----	The management of the main zone must be done in tight coordination with the management of the other two zones.
PT. Taman Wisata Candi Borobudur, Prambanan dan Ratu Baka	The management of the buffer zone and development zone in accordance with tourism activities whose orientation is and will be the increase of the tourists	Making supporting facilities for tourism activities	Promotion activities using Prambanan temple as an idol used to increase the income out of tourism: ticketing,] renting the facilities for tourism activities.	Tourism activities in and out of Prambanan temple compound raise a big amount of money. But, it must be in balance with the preservation/conservation principles of an archaeological area.
Local governments (Sleman regency and Yogyakarta province) Sleman dan Propinsi DIY)	As the authorities of the area	-----	-----	There must be a broader role of the local government not only as the owner of the administrative area. Local government can take role in the lay-out plan of the area.

Stakeholder Group	Attitude/Agenda	Representation in tourism planning (actual or potential)	Participation in tourism benefits (actual or potential)	Comments
Artists group	Their performance is an integral part of the tourism activity in the Prambanan compound	Scheduled art performance in the compound must be developed in the future, e.g. the varieties, the continuity.	The price of the entrance ticket including the price of the performances.	Good coordination and cooperation between the management and the local artist groups is very important. It must be improved continuously to increase the role of the community in the tourism, based on appreciation and preservation of the local art.

10. Tourism

Item	Rating (0-5) or *Amount	Comments
Area Infrastructure		
Air Access	4 rating	The distance to the nearest airport is less than 5 km.
Ground Transport	4 rating	There is public transportation to Prambanan temple compound using buses either with AC or without AC
Complementary Attractions	4 rating	Ramayana outdoor ballet, local traditional art performance

Item	Rating (0-5) or *Amount	Comments
Accommodations	3 rating	Good non-star hotels and inns.
Personal Safety	5 rating	There are enough security personnels from BP3 and PT Taman Wisata, who work 24 hours in shifts. Their main duty is watching the temples. There is also police posts in the front of the compound.
Site		
Annual Visitation – 2000	1.109.375	Domestic tourist is 1.017.400, Foreign tourists : : 91.975
Annual Visitation – 2005	964.181	Domestic tourists is 888.544 , Foreign trourist : 75.637
Annual Visitation – 2010	1.077.902	Domestic tourists : 944.711 . Foreign tourists : 133.191
Proportion of foreign visitors	9.37 %	The quantity of foreign tourists from the year 2000 – 2010 is 927.466 out of the whole quantity 10.376.922 people
Estimated Ave. Length of Stay	1-2 days	It is a short trip/visit
Entry Fee – Domestic	Rp. 20.000	There is discount programm for students: 50% out of the daily ticket price . Rp.23.000 at Sunday
Entry Fee – International	\$ 13	
Annual Revenue	?	Restricted Data and need special permission from Minister
Site Access / Transport	Private transportation and public busses	Individual tourists usually come to Prambanan by private transporatation, but mass tourism usually use buses.

Item	Rating (0-5) or *Amount	Comments
Parking	1 point	The parking area is spacious enough to accommodate vehicles bringing the tourists (bus, car, motor bike, bicycle).
Security / First Aid	4 rating	First Aid facilities, security persons
Restrooms	12 units	Placed in several points through the area, except the main courtyard
Refreshments	Many units	There are two good restaurants, and many refreshment vendors in the development area
Rest areas	12 points	Rest area are in 12 points in the 2 Ha area
Crafts/souvenirs	124 units	There are souvenir vendors having no permit card. They occupy non permanent kiosks
Site access/circulation		The flow of the visitors is arranged into the in- coming gates and the out-going gates. This circulation pattern is designed so as the visitors do not collide each other or creating “traffic “ jam among them .
Interpretive Center	1 point	It is enough
Guides	32 persons	They are partners of PT. Taman Wisata
Interpretive Signage	3 rating	Adequate
Interpretive Literature	3 rating	Adequate

The first tourism appeal is the temples itself with the cultural landscape, the second is the Ramayana Ballet performance, the third is the location which is close to the city of Yogyakarta (itself is also tourism destination), close to the airport- railway station-bus terminal-main roadway. As mentioned above the temple compound itself is highly potential, the transport facility is also good, community around the temple compound also gives good response to have performances- selling souvenir, refreshment-guide etc.- as far as the present day the political atmosphere is good, it is also well-known among the local-regional-national-international communities. Therefore Prambanan temple compound has good potency in tourism development either local, regional, national, and international as well.

The most significant obstacles to tourism development at the site is natural disaster in this locality.

The most urgent priorities for the development of tourism at the site?

1. Development of the nearest airport
2. Finding the exact restoration technique for Siwa Temple
3. Better development of the management of the 2nd and 3rd zones

Bibliography

- Adrisijanti, Inajati dan Sektiadi (ed.). 2010. *Lindhu Ageng Ngayogyakarta: Warisan Budaya Pascagempa Bumi 27 Mei 2006*. Yogyakarta: Balai Pelestarian Peninggalan Purbakala Yogyakarta.
- Adrisijanti, Inajati dan Andi Putranto (ed.). 2009. *Membangun Kembali Prambanan*. Yogyakarta: Balai Pelestarian Peninggalan Purbakala Yogyakarta.
- Jordaan, Roy E (ed.). 1996. *In Praise of Prambanan: Dutch Essays on the Loro Jonggrang Temple Complex*. Leiden: KITLV Press.
- Mundardjito. 1993. "Pertimbangan Ekologi dalam Penempatan Situs Masa Hindu Budha di daerah Yogyakarta: Kajian Arkeologi-Ruang Skala Makro". *Disertasi*. Program Pasca Sarjana Universitas Indonesia.
- Riyanto, Sugeng. 2006. "Pengelolaan Informasi di Taman Wisata Candi Prambanan: Kajian tentang Keterkaitannya dengan Peningkatan Apresiasi Masyarakat terhadap Benda Cagar Budaya". *Tesis*. Program Studi Arkeologi, Jurusan Ilmu-Ilmu Humaniora, Program Pasca Sarjana UGM.
- Setyastuti, Ari. 2010. "Daya Dukung Fisik Zona 1 Candi Prambanan" dalam *Buletin Narasimha* No. 03/III/2010. Yogyakarta: Balai Pelestarian Peninggalan Purbakala Yogyakarta.
- Setyawan, Hari. 2007. "Potensi dan Pengelolaan Sumber Daya Flora Kawasan Prambanan Abad IX-X M (Studi Kasus Melalui Relief Candi Prambanan dan Sojiwan)". *Skripsi Sarjana*. Jurusan Arkeologi, Fakultas Ilmu Budaya UGM.
- Soediman, Drs. *Chandi Laradjonggrang in Prambanan*. Yogyakarta: tanpa tahun.
- Soekmono, R. 1995. *The Javanese Candi: Function and Meaning*. Leiden: E. J. Brill.

Wirasanti, Niken. 2000. "Pemanfaatan Sumberdaya Lingkungan pada Masa Mataram Kuna Abad IX - X Masehi (Studi Kasus Wilayah Prambanan dan Sekitarnya)". *Tesis*, Program Studi Ilmu Lingkungan, Jurusan Antar Bidang, Program Pascasarjana UGM.

