The Monastery of San Juan de Duero grew out of a church built in the 12th century in the Romanesque style. Its simple design of a single nave and apsidal sanctuary was executed using rubblework for the walls and stonework for the arches, doorways, openings and vaults. The sanctuary is covered by a furnace vault, while the presbytery in front has an ogive barrel vault whose entrance is framed by a great triumphal arch. The arch is also ogive or pointed, and it stands on capitals decorated in acanthus leaf, palmette and pineapple plant motifs and supported by half-columns. The nave's modern-built roof is wooden.

After the defeat of the Moors, King Alfonso I was anxious to repopulate Spanish lands with Christians, and his repopulation program favored the Knights Hospitaller of Saint John of Jerusalem. The Knights Hospitaller chose
this site. Almazán and Ágreda as their new strongholds in the province of Soria. Because their order’s mission was to protect and shelter foot travelers, pilgrims and the helpless, the knights used to settle just outside cities, along the roads travelers would have to take to get in.

It was the Knights Hospitaller who were responsible for building this monastery. First they remodeled the church to suit their own style of worship. In doing so, they erected two little temples in the nave along the way to the sanctuary, whose little ribbed cupolas mark a precise moment in architectural evolution, the development of the groined arch. These temples show that their makers knew about new systems of building but failed to really grasp the function the new developments were meant to perform.

These little temples, which act to stress the separation between the nave and the sanctuary, are adorned with capitals and corbels sporting figures, fantastic beings and biblical passages.

The cloister, standing next to the church’s southern wall, is made up of a number of spans of arches, each handled in a different way.

The section closest to the northwest corner is Romanesque in design and features semicircular arches perched on figured capitals erected on top of a running podium. At some time soon afterward in the early 13th century, the cloister was apparently completed with interlacing arches that tell of Islamic influence. One span of domed arches sits on top of monolithic sheaves of four half-columns; another section sprouts interlacing openwork arches
that loop at the point where they spring off their fluted, capital-less pilasters. The last span also boasts interlacing arches, but this time the arches rise tangent and stand on attached columns with capitals decorated in a plant motif.

The corner at each of the three sections ends in a bevelled opening, and the sections are joined to one another with buttresses, except on the southern side, where there is an opening with a hanging keystone.

The entire cloister is carved from sandstone from Valonsadero, which is near the city of Soria. The cloister sits on an unbroken strip of stone and mortar foundation that was laid without using forms, so its shape is not really uniform.

The arched entrances to the monastery's different rooms still stand, out of place, along the side walls closing off the cloister. Also evident are the marks of the various remodeling efforts the building has undergone.

The entire cloister area was used as a burial place. There are tombs with lined with stone slabs, with stone lids whose ends are sometimes worked into an anthropomorphic shape, all oriented along an east-to-west line. They, like the tombs embedded in the church walls, are dated to the Low Middle Ages.
The excavations that have been carried out on the monastery's grounds confirm that there were at least two periods of prolonged occupation. One coincides with the Low Middle Ages, and the other, interlacing with the first, runs up to the 17th century, at which point the monastery was completely abandoned as a residence, although worship probably continued there into the next century. After that the building began to fall into ruin; its walls were used as stables, and its outlying land was dug up for vegetable patches. Only its church was rebuilt and repaired, and that on various occasions. The City Council eventually lent a hand toward keeping the church in repair, since the Jurados (local officials sworn to defend the community's interests) used to celebrate the Feast Day of Saint John in the San Juan church each year. When San Juan was declared a national monument in 1882, the proclamation accorded the monastery official recognition of its artistic value but failed to engender increased respect among the local citizenry; the numerous budgets drawn up for works and repairs in the years following include a documented item from 1902 for dissuading people from penning up their livestock in the monastery.

In 1934 during its stint as part of the Celtiberian Museum, San Juan de Duero was a museum of stone inscriptions, and since then it has acted as the venue for various different collections. The current exhibition at the monastery, converted into the Medieval Section of the Numantian Museum, offers a panoramic view of the Middle Ages in Soria, with tangible remains from the Christian, Arab and Jewish cultures.